MICRO - MAINFRAME MARKET ANALYSIS

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Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

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MICRO-MAINFRAME MARKET ANALYSIS

MICRO-MAINFRAME MARKET ANALYSIS

ABSTRACT

Today, a basic incompatibility exists between the ever increasing number of micros and the existing corporate mainframes. As the trend continues toward a more integrated office, the need for micros to efficiently access host data becomes apparent. As a result, the micro-mainframe link has become a focal point of interest in both the hardware and software industries.

This report identifies the factors behind the demand for micro-mainframe products and provides a five-year market forecast. In addition, key issues, trends, and developments are presented. Business and market strategy recommendations are provided for vendors interested in increasing their market penetration.

This report contains 112 pages, including 32 exhibits.

M-CMM-297

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CONTENTS

INPUT
M-CMM-297

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MICRO-MAINFRAME MARKET ANALYSIS

EXHIBITS

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I INTRODUCTION

I   INTRODUCTION

- This study was produced for the Microcomputer Software and Services Program as part of INPUT's 1985 Market Analysis and Planning Service (MAPS) for the information services industry.

A.   PURPOSE AND SCOPE

- This report examines market issues, trends, and developments in micro-mainframe links as they relate to major information services industry trends.

- The demand to integrate microcomputers with the corporate mainframe environment has increased, making efficient access of the host data by microcomputers crucial. As a result, the micro-mainframe link has become a focal point of interest for vendors of both hardware and software.

  - Most major software vendors are working on products and/or joint arrangements with other companies so that their product lines can function in a distributed processing environment.

  - However, the profusion of announcements of products (and some pseudo products) has made it more difficult to identify and understand the real issues. Most current vendor products and corporate plans are preliminary (where they are not primitive).

- 1 -

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- INPUT believes that the group of user requirements globally referred to as "micro-mainframe" could produce a discontinuity in data processing at least as large as that produced by the System/360 introduction. With this in mind, the micro-mainframe issues go well beyond simple technical tasks such as screen versus file transfer.

- The study examines several key issues:

    - What link strategies will IBM incorporate in future products?

    - How will technological changes affect micro-mainframe functions?

    - Will current micro-mainframe link vendors remain leaders?

B.   METHODOLOGY

- The research for this study included 14 telephone interviews, other INPUT programs and reports, secondary sources, INPUT files, review of trade press literature, and previous INPUT research.

- The interviews were used to gather data, opinions, and plans for the purpose of performing the analysis for this study. The interview technique included the use of many open-ended questions in an effort to provide INPUT clients with maximum feedback on the current thinking of involved participants.

- Those interviewed included:

    - Major independent mainframe software vendors.

    - Local area network vendors.

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- Major terminal emulator manufacturers.

- Microcomputer hardware suppliers.

- Microcomputer application software vendors.

- A copy of the questionnaire is included in Appendix A.

- Excluded from this report are:

  - Modems.

  - Protocol converters.

  - Micro software packages that are or include asychronous links modems (i.e., Framework, Symphony).

  - IBM emulation software and products.

  - Links to Dow Jones, The Source, or other public data bases.

C.   DEFINITIONS AND RELATED INPUT REPORTS

- INPUT defines a mainframe as a higher order processor. Therefore a microcomputer linked to a System 36 or 4300 is a micro-mainframe link, as is a microcomputer linked to an IBM PC-AT that acts as a file server or controller and central processor. Microcomputer definitions are included in Appendix C.

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- In tandem with this study, INPUT's ISPS program conducted over 100 structured interviews with IS managers in large corporations. Data from these interviews is incorporated in this study's user and corporate needs sections (see IV-B and IV-C). The user and vendor questionnaires are found in Appendix A and Appendix B, respectively.

- More comprehensive analysis of the is included in the following 1985 information services studies:

    - <u>Micro-Mainframe End-User Experiences</u> describes various micro-mainframe linkage methods and their advantages and limitations. It suggests implementation strategies and projects changes in the technology and marketplace.

    - <u>Micro-Mainframe Connectivity</u> analyzes the advantages and drawbacks of various microcomputer communications methods and projects changes in these methods as they relate to micro-mainframe.

    - <u>Micro-Mainframe Software Planning</u> categorizes the massive number of micro-mainframe software products necessary to accommodate micro-mainframe access, with special attention to security and data integrity requirements. The report recommends a software development/acquisition strategy.

    - <u>Micro-Mainframe Corporate Impact</u> describes the organizational and technological effects of micro-mainframe in the corporation, in light of the growing demand of end-user access to the corporate data base. The impact of micro-mainframe products on the current inventory of standalone micro and mainframe software is also analyzed.

- 4 -

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II EXECUTIVE SUMMARY

II EXECUTIVE SUMMARY

- This executive summary is designed in a presentation format in order to:

    - Help the busy reader quickly review key research findings.

    - Provide a ready-to-go executive presentation, complete with script, to facilitate group communication.

- The key points of the entire report are summarized in Exhibits II-1 through II-5. On the left-hand page facing each exhibit is a script explaining its contents.

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A.   MICRO-MAINFRAME LINK MARKET CONFUSION

- The present micro-mainframe link marketplace is in a state of confusion, making link purchasing difficult for IS. Consequently, shipments of link products have been low; only about 150,000 micros were linked directly to mainframes in 1984 (see Exhibit II-1).

  - There is an absence of communication and operating system (OS) standards, and although the general consensus that the IBM PC sets the corporate standard is aiding in alleviating compatibility problems, establishing standards takes time.

  - There is also no standard micro-mainframe product. Products range from low-end terminal emulators to sophisticated high-end products that extract selective host data, provide downloading to a microcomputer, and upload new data. Prices range from $1,000 to $75,000, depending on the product and number of microcomputers linked.

- Most link products require IS involvement. "Packaged" links must often be customized for specific corporate data bases and applications. Nontechnical end users find that the accessing of host data is complicated and impedes user productivity. Easy user interfaces (such as videotex, artificial intelligence, or voice recognition) will be incorporated in future link products to alleviate this problem.

- IBM has not provided a total link solution--at best their connections have been piecemeal. Corporations fear purchasing expensive products that IBM may obsolete farther down the road.

- 6 -

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EXHIBIT II-1

- 7 -

MICRO-MAINFRAME LINK MARKET CONFUSION

- **Lack of Standards**

  - **Communication**
  - **Operating Systems**
  - **Product Features**

- **Enormous Price Variance**

- **Products Are Complicated and Do Not Provide a "Total Solution"**

- **"What Will IBM Do?"**

B.   OFFICE CONNECTIVITY

- INPUT believes connectivity is a very significant office trend. Seventy percent of all microcomputers in business are expected to be linked; however, micro-mainframe is only one way to provide the connectivity. Other ways include LANs, CBXs, and multiuser systems.

- In 1984 only about 3% of the microcomputers installed in business were physically linked to in-house hosts. In 1990 about 12% are expected to be physically linked, with another 9% being linked on a more "casual" basis via modem and communication software.

- INPUT projects that in 1990 85% of the microcomputers in business will be used for analytical (primarily spreadsheet) type functions and 15% for operational processing tasks such as manufacturing and production. Modem links and LANs will be the connectivity methods which predominate for these analytical functions. Direct micro-mainframe linkage will probably be the connectivity method employed by operational workers (e.g., data entry, programming personnel) who need to access host data on a timely, ongoing basis (see Exhibit II-2).

- 8 -

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EXHIBIT II-2

OFFICE CONNECTIVITY
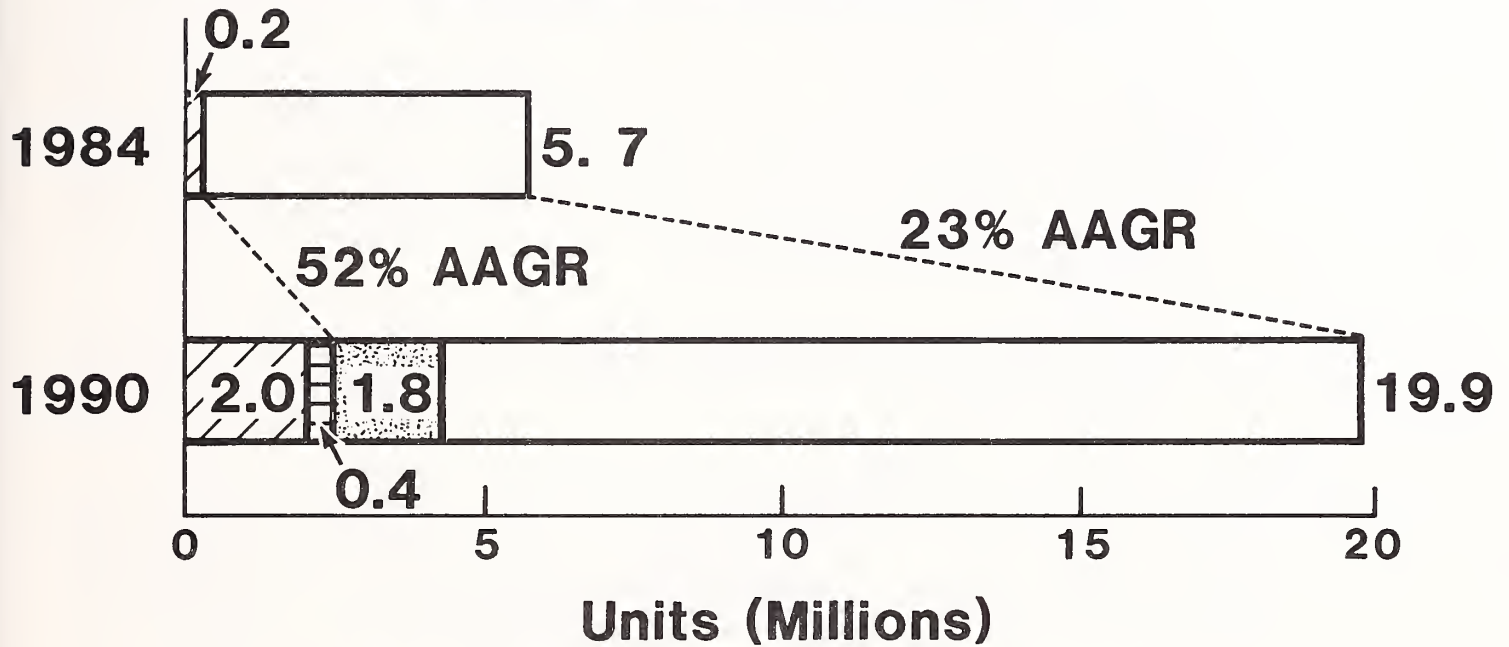
Units (Millions)

Business Microcomputer Installed Base
1984-1990

▨ Linked via Emulator

▤ Linked via Hardwired ROM (e.g., IBM PC/3270)

▦ Linked via Modem-Communication Software

C.   MICRO-MAINFRAME LINKAGE GROWTH

- Industry trends such as technology growth and IBM strategy impact the micro-mainframe market.

    - Technology changes, such as VLSI circuits, will impact the micro-mainframe market both positively and negatively. Easier user interfaces and transparent host access will be developed. Increased chip capability will also provide greater memory storage and processing abilities, enabling much of the data now stored only on a host to reside permanently on a microcomputer.

    - IBM's strategy is one of office centralization through a hierarchical network.

- IBM's micro-mainframe link approach will redefine the distributed processing hierarchy and eliminate high-performance minicomputer systems operating under reasonably efficient operating systems such as UNIX.

    - Large mainframes will provide centralized control of the network and distributed data bases.

    - Intelligent workstations (microcomputers) will handle program development and maintenance as well as simple transaction processing against personal data.

- Corporate needs for data security and integrity and user needs for more timely host data are also affecting micro-mainframe linkage.

- This push-pull from all corners, coupled with the trend toward distributed data processing (DDP) using LANs and multiuser systems, will limit the micro-mainframe market to a 27% AAGR from 1984-1990 (see Exhibit II-3).

- 10 -

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EXHIBIT II-3

MICRO-MAINFRAME LINKAGE GROWTH
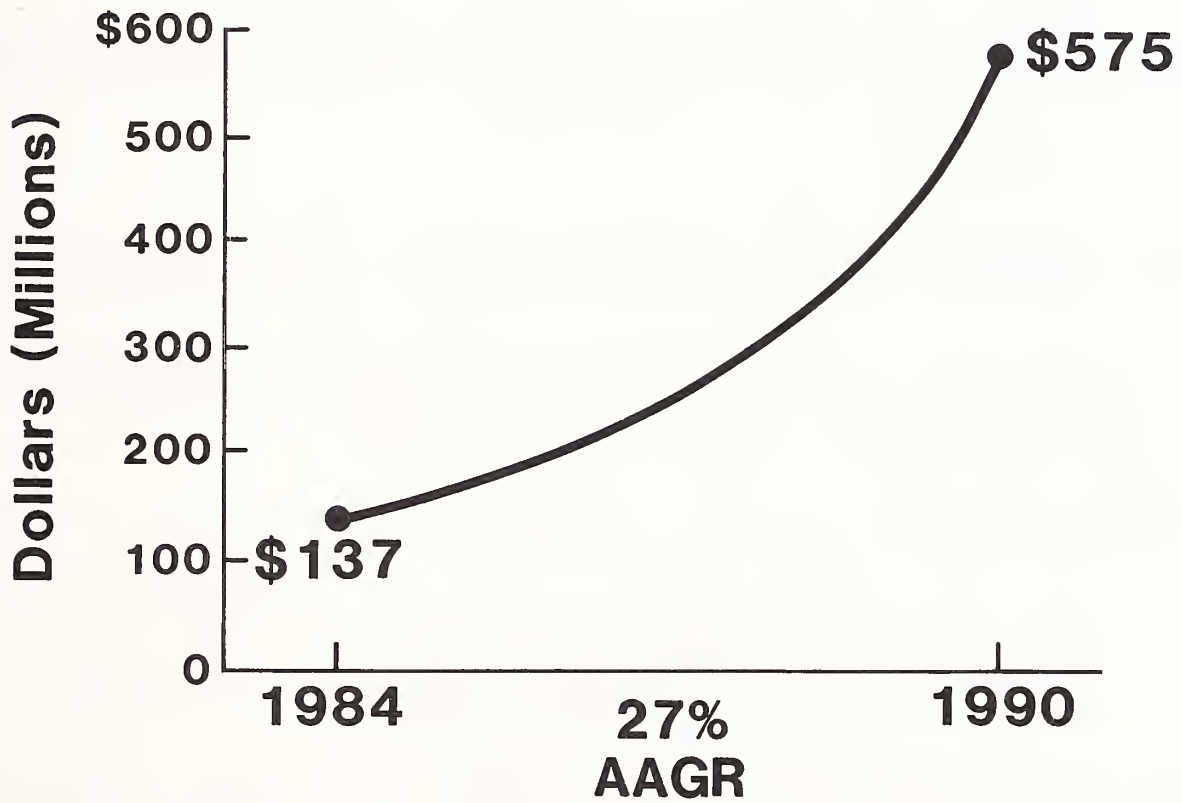
D.   MICRO-MAINFRAME MARKET TRENDS

- The micro-mainframe linkage market will continue to have significant growth but does not offer broad opportunities to a large number of present and future participants. 1984 market leaders gained their positions due primarily to early market entry and can in no way be considered established leaders. The number of market participants will increase in 1985-1986, but by the end of the decade will level out to a manageable number of known leaders, primarily involved in joint ventures to produce, distribute, and market micro-mainframe linkage products.

- The micro-mainframe connection market in 1984 is one of confusion, analogous to the independent mainframe software product market in 1971, which lacked set price and support. Like this market, as the micro-mainframe connection market matures, standards in technology, function, and price will be established.

- The primary method all types of business users employ today to access host data is direct physical linkage to the host. With technology changes and more office automation solutions, a large majority of these workers will be able to obtain their host data from a file server or processor in a LAN or by a modem connect to host. Direct micro-mainframe links will be used by employees with specialized job functions as well as by analytical and managerial workers.

- Distributed data processing (DDP) will affect the micro-mainframe linkage market. DDP will evolve to include advanced application program-to-program communications, allowing microcomputer applications to communicate with host applications. Mainframe software will be modified to take advantage of distributed processing on microcomputers.

- The information systems (IS) role is turning into one that is solution-oriented, rather than one which concentrates on tools and development. IS is being called on increasingly for end-user training and support, especially for micro-mainframe linkage.

- 12 -

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EXHIBIT II-4

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MICRO–MAINFRAME MARKET TRENDS

	1984	1990
Micro-Mainframe	No Established Leaders →	Leaders and Cooperative Agreements
Micro-Mainframe Market	Confusion →	Standards
User Access Via . . .	Direct Micro-Mainframe Link Only →	Remote Network & LAN Links Also
Processing	Centralized Processing →	DDP
Information Systems (IS) Role	Tools & Programming →	Solutions & Training

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E. RECOMMENDATIONS AND OPPORTUNITIES

- Since micro-mainframe linkages combine a number of different products and technologies, a solution approach employing joint marketing and/or distribution by a variety of company types will provide the widest opportunities.

  - The emulation company will provide the physical link, the communications company will provide the communications component, the microcomputer software vendor will provide the user-friendly microcomputer link piece, and the mainframe software vendor (not known for user-friendly applications but for technically complex products with security features) will provide the host linkage.

- Service, support, and total product distribution (PC micro piece, host piece, emulator board) should be provided by mainframe software vendors. They already have an excellent reputation for service and support. Their national sales networks have already established corporate accounts; this will help shorten the sales cycle.

- Microcomputer software vendors should also consider joint ventures with service bureau companies to develop packages or utilities for the remote linking of microcomputers with their data bases and DDP microcomputer products that would be segments of a mainframe application but would offload some of the processing from the host. Cooperative ventures with mainframe software vendors are also in order here.

- Microcomputer communication software vendors may also consider cooperative efforts with other vendors--perhaps hardware suppliers. One example is the marketing and distribution arrangement between Data General (CEO office automation system) and Communications Research Group Inc. (BLAST communication software).

- 14 -

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EXHIBIT II-5

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RECOMMENDATIONS

- **Pursue Strategic Partnering**

- **Capitalize on Your Business Strengths**

- **Provide Service & Support**

- **Distribute All Link Pieces through One Channel**

- **Look for Consulting Opportunities**

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III MARKET ANALYSIS

III   MARKET ANALYSIS

A.   WHAT IS MICRO-MAINFRAME?

- A micro-mainframe link in its most basic definition is a product that allows downloading, the passing of data from the mainframe data base to a micro-computer. Exhibit III-1 shows the micro-mainframe connectivity hierarchy.

    - In the near past when microcomputer users wanted mainframe data it needed to be extracted by IS and rekeyed from reports into the micro-computer.

    - Within the past three to four years a variety of products with different degrees of sophistication have evolved which provide microcomputer users with host data. INPUT has segmented this link market into two segments--terminal emulators and intelligent links (see Exhibit III-2).

1.   EMULATORS

- A terminal emulator converts the microcomputer to a mainframe terminal with the ability to make an inquiry and have some downloading capabilities on a per screen basis.

- 17 -

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EXHIBIT III-1

HIERARCHY OF MICRO-MAINFRAME CONNECTIVITY

5. Integrated, Intelligent Applications Pro-
    grams (Coordinated Processing Between
    Mainframe and Micro) Using the Virtual
    Floppy Method

    ● Batch and Interactive

4. Logical Data Bases Covering

    ● Multiple Hardware and Software
      Environments

3. File Exchanges (Bidirectional)

    ● Low or High Speed, Proprietary or
      Generalized Structure

2. Downloading - Low Speed

    ● Extracts and Operational Files

1. Manual

    ● New and Rekeyed Data

Status
Today
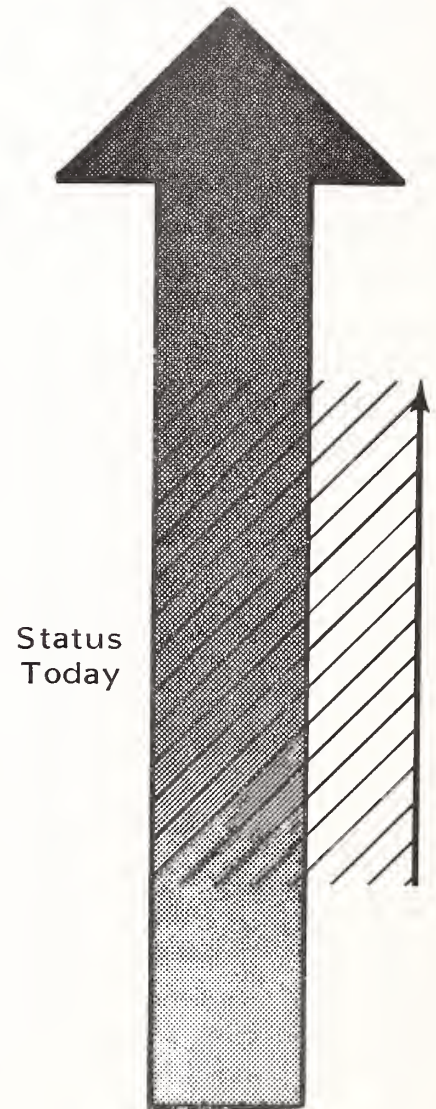
Key: Darker Shades Indicate More Complex
      Issues/Unresolved Implementations

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EXHIBIT III-2

LEVELS OF MICRO-MAINFRAME LINKS

LEVEL ONE — Rekey Host Data (IS) into PC

LEVEL TWO — Terminal Emulation

LEVEL THREE — Intelligent Links

- Virtual Disks

- Application Specific

- Database Specific

- Intermediate Processor

LEVEL FOUR — Distributed Data Processing

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- Major emulator vendors include:

    . AST Research.

    . CXI Inc.

    . DCA.

    . Forte Communications Inc.

- A major factor for installing terminal emulators is cost--an average emulator package costs between $800-$1,000, much less than intelligent links.

- Dumb and intelligent terminal vendors are being impacted by emulating microcomputers (over 18% of recently installed 3270 products are microcomputers); however, there will continue to be a market for specialized terminals (which access data faster than a microcomputer with emulator), especially as terminal prices continue to decline and additional functions are added.

2. INTELLIGENT LINKS

● Intelligent products connect the microcomputer into the production data base or application. Products vary in sophistication from single data batch downloading to selective file downloading and uploading with single microcomputer user interfaces. In the majority of cases IS assistance is required in same form . Products include:

- Those based on the virtual disk concept, such as TempusLink by Micro-Tempus, which downloads and stores data into a VSAM file on the host that appears to be the users' own hard disk.

- 20 -

- Application specific links that integrate microcomputer processing with proprietary mainframe applications software packages (e.g., MSA's PC Data Entry).

- Data base specific links that link a vendor's proprietary data base (e.g., Cullinet's IDMS) or IBM data base (IMS) (e.g., Informatic's General "Answer/DB" and "Answer Series") with a variety of microcomputer application packages such as Lotus 1-2-3 and Visicalc.

- Intermediate processor links that connect the mainframe with a file server or with a minicomputer or multiuser product. These products in turn serve as the controller of a number of microcomputers, providing them with the needed host information. Examples include IBM's System/36 and Nestar's Plan/4000.

- Truly universal links which support a wide variety of both micro-computer and mainframe software are not yet available. This is causing IS to delay implementation as there is understandable reluctance to be locked into specific software on either end of the micro-mainframe link; IS also tends to wait for needed applications rather than accept limited products.

- Benefits and limitations of types of micro-mainframe linkages are shown in Exhibit III-3.

3. THE IDEAL LINK

- The best micro-mainframe connection approach is the one which works best for the individual need. Simple data base access can be done through terminal emulation, although this has the effect of reducing an intelligent micro-computer to a dumb terminal, albeit sometimes with downloading capabilities.

- 21 -

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EXHIBIT III-3

TYPES OF MICRO-MAINFRAME LINKAGES

	CHARACTERISTICS	BENEFITS	LIMITATIONS
Terminal Emulation	Modems and plug-in boards.	Micros connect to mainframe, extending utility.	Micro becomes dumb terminal: only views data. Local processing not possible during emulation.
File Transfer	Mainframe files bulk transferred to micro.	Mainframe data can be used by micro.	Customized programming required on both mainframe and micro. Slow, as only entire files are downloaded. Requires large storage capacity on micro.
Intelligent Links	Integrate with mainframe applications. Central storage areas often appear as floppies to users.	Data extracts from several files available for integration into micro applications. Higher speed access by micro. Micro data sometimes available to mainframe.	Only accesses specific applications or file structure.

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- A generic ideal micro-mainframe implementation automates tasks which otherwise require knowledge of the mainframe's command structure.

  - This means simplified log-on procedures, menus, on-line help facilities and a micro-based data dictionary, essentially a directory to the various data bases, applications and services accessible through the system.

- Advocates of distributed data processing see the ideal consisting of many network nodes, each with resident data. The end-user's node locates requested information anywhere on the network and converts it to micro format.

  - The process is transparent. Users are not required to know data addresses, and node intelligence can even handle conversion and communications between the dissimiliar systems.

- This ideal system has a simple, consistent user interface requiring little IS involvement.

  - "Fill-in-the-blanks" screens will help users build queries, and eventually, natural languages (noncomputer specific commands), voice commands, or artificial intelligence will provide assistance in appropriate settings, for those willing to pay the price.

- The technology is fast approaching these capabilities. But most current micro-mainframe products are not universal solutions. They are usually limited in the types and brand names of the applications they service. Generic solutions are just emerging.

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B. EVOLUTION AND STATE OF THE MARKET

• Link technology has only been around for about three years yet has had a great impact. Early links provided terminal emulation for accessing read only corporate information. As the number of microcomputers in companies increased and users became more sophisticated (especially spreadsheet users) they began to demand more capable and flexible links to access primarily the financial and planning information on the mainframe.

- To provide a link, companies must consider:

  . Physical connection.

    - Acync modem through ordinary dial-up lines.

      . Low-cost, easy to install.

      . Only 300 or 1,200 baud.

    - Sync--coaxial cable and board.

      . Faster.

      . Coax costs more.

      . For communication over a distance leased lines are required.

- How to get in touch with the host.

  . File transfer.

  . Terminal emulation.

- 24 -

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- How to get the host information.

  - Most host data base and DSS programs have report generators and/or data query programs--extracts need to be created.

- The present link market place is in a state of confusion, making link purchasing difficult for IS. Consequently, shipments of link products have been low (see Exhibit III-4).

  - There is an absence of communications and operating system standards.

  - Most link products still provide low level connection without sophisticated file transfer capability and must often be customized to permit mainframe data to be effectively transmitted.

  - End-user training is also generally necessary.

  - Many companies have several mainframes and/or custom applications written on them. Consequently, "packaged" link products cannot access these products.

  - Most vendors of intelligent links are mainframe software vendors whose links are designed only for their mainframe software and more popular data bases.

  - Prices for link products range from $1,000 to $75,000.

  - IBM has not provided a total link solution--at best its connections have been piecemeal. Corporations fear purchasing expensive products that IBM will obsolete farther down the road.

- Several problems which are inherent to or created by link products also make it difficult to implement link solutions.

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EXHIBIT III-4

- 26 -

MICRO-MAINFRAME MARKET TODAY

- Confusion

  - Lack of Standards

  - No One Product Provides the Total Solution

  - No Product is "Standard" for a Specific Application

  - No Vendor Currently Controls the Market

  - What Will IBM Do?

  - No Average Price

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- Most problems with link products occur in the data communications stage between host and microcomputers. The extraction and data transfer are time consuming thereby increasing the use of the existing communications network.

- Many packages don't provide transmission restart and recovery facilities; they rely on the mainframe software accessed.

- Users must be familiar with mainframe log-on and file name conversions--something most managers don't know or care to know.

- Host data on diskettes of users is susceptible to loss, piracy, or damage.

- Many products have:

  - Limited throughput.

  - Response time delays.

  - Inaccurate or incomplete conversions from mainframe to micro-computer formats.

C.   1984 INSTALLED BASE OF MICRO-MAINFRAME LINKS

- In 1984 there were 5.7 million microcomputers installed in business. Of that installed base about 53% (or 3 million) units were in businesses with over $10 million in revenue and 2.7 million in businesses with under $10 million in revenue.

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- In 1984 almost all micro-mainframe links were in businesses over $10 million. Larger companies have DP budgets large enough to afford connections as well as more sophisticated end users who demand host access. Consequently, the 1984 market is presented for businesses over $10 million in revenue. Section D shows projections for all businesses.

- Small businesses will increasingly purchase multiuser systems and LANs that have mid-processors linked to a host (mini or mainframe).

- Small businesses, like large ones, will demand linking to the hosts in an office setting.

- Only 5% of the microcomputers in businesses over $10 million are now linked to mainframes (see Exhibit III-5). This small percentage is due to:

  - Market newness and confusion.

  - Product limitations.

  - IS fears of loss of computing control and data security.

  - Planning considerations--the mechanism is not in place.

- That 5% consisted primarily of simple terminal emulation packages whether from a unit or user expenditure perspective. This is because:

  - Emulation packages have been on the market longer (three years) than intelligent links. (Few packages are over one year old.)

  - They cost less ($800-$1,500 versus total intelligent links of $4,000-$5,000 per node).

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EXHIBIT III-5

MICROCOMPUTERS LINKED TO MAINFRAMES
1984

Linked

5%

95%
Not Linked
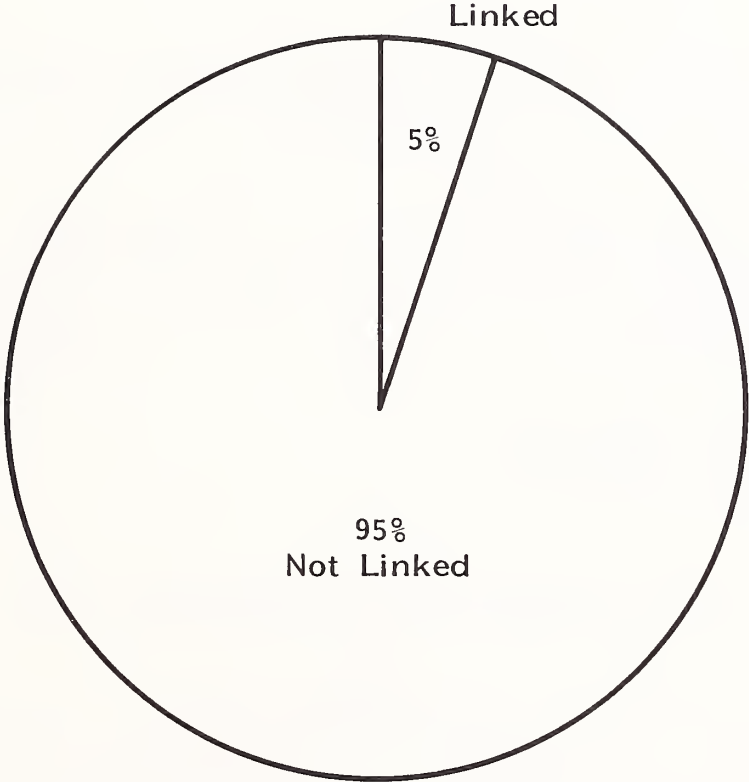
3 Million Microcomputers
Installed Base of Micros in
Businesses Over $10M in Revenue

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- They do less than intelligent packages thereby giving the IS director less to fear from a data security and integrity standpoint as well as requiring less IS involvement and time.

- See Exhibit III-6 for micro-mainframe user expenditure and unit installed base numbers.

- Exhibits III-7 and III-8 present 1984 market share by units for the major vendors.

  - In most cases the market leaders were the first to enter the market-place.

  - Since the micro-mainframe is so new and volatile, 1984 market share lead in no way ensured success in the years to come.

D.   FORECASTS, 1985-1990

- Market assumptions affecting micro-to-mainframe linking are as follows:

  - The micro-to-mainframe link in a LAN or multiuser system is the one product (controller) or microcomputer directly linked to the mainframe (each node in LAN is not counted).

  - Intelligent link packages must be linked to a microcomputer with an emulator package, but since they are rarely bundled, the intelligent package is counted separately in the market shipment forecast but not in the installed base of linked microcomputers. However, micro-mainframe is only one way to provide this connectivity (see Exhibit III-9).

- 30 -

EXHIBIT III--6

MICROCOMPUTERS LINKED TO MAINFRAMES
1984

TOTAL UNITS
(150)
(Thousands)

17.4
Intelligent
Links

150
Emulation
Packages*

TOTAL USER EXPENDITURES
(172)
($ Millions)

$52
(30%)
Intelligent
Links

$120
(70%)
Emulation
Packages
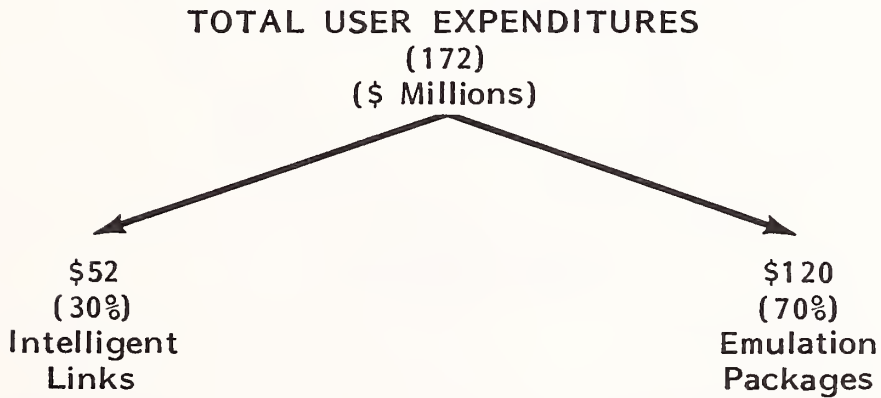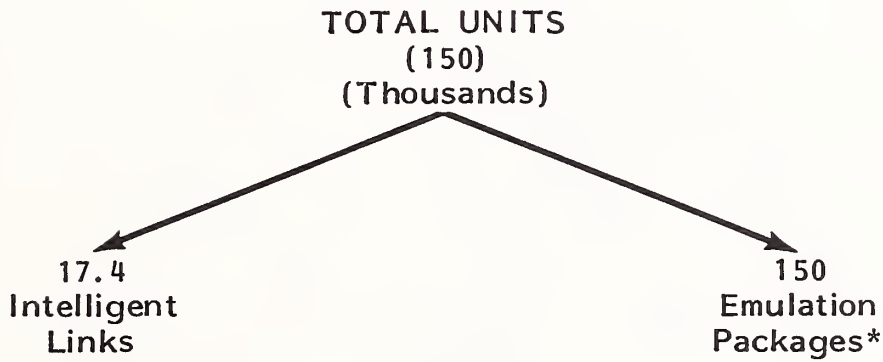
* An emulation package is a necessary component of
intelligent link products but is sold separately

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EXHIBIT III-7

MARKET SHARE OF EMULATION
PACKAGE VENDORS
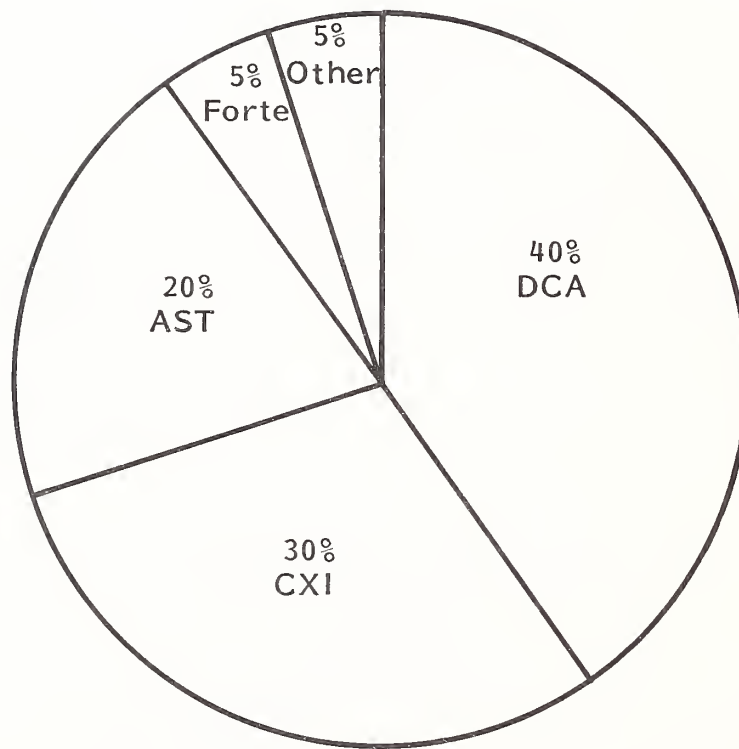
1984 Installed Base
*150,000 Units

* Emulation packages that are used with intelligent links are also included.

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EXHIBIT III-8

MARKET SHARE OF
INTELLIGENT PACKAGE VENDORS

43%
Micro Tempus

11%
Cullinet

11%
McCormack &
Dodge

35% Total

1984 Installed Base
17.4 Thousand
Units

Informatics	6%
MDS	6%
Software AG	6%
MSA	4%
Other	13%
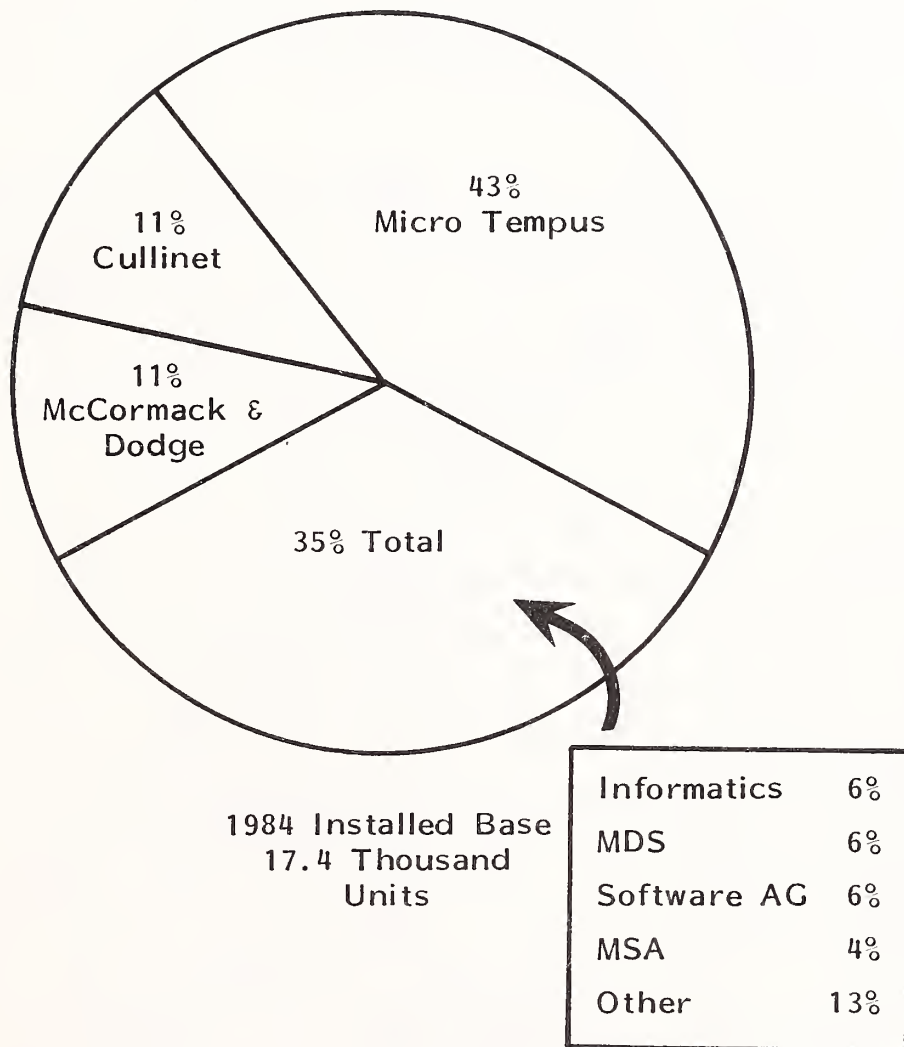
EXHIBIT III-9

INSTALLED BASE OF MICROS IN BUSINESS

1984

90%
Standalone†

3%   LAN 150,000 Units

7%   Multiuser*
      400,000 Units

5.7 Million Units

1990

30%
Standalone †

70% LAN
11 Million and
Multiuser* (15%)
3 Million

19.9 Million Units
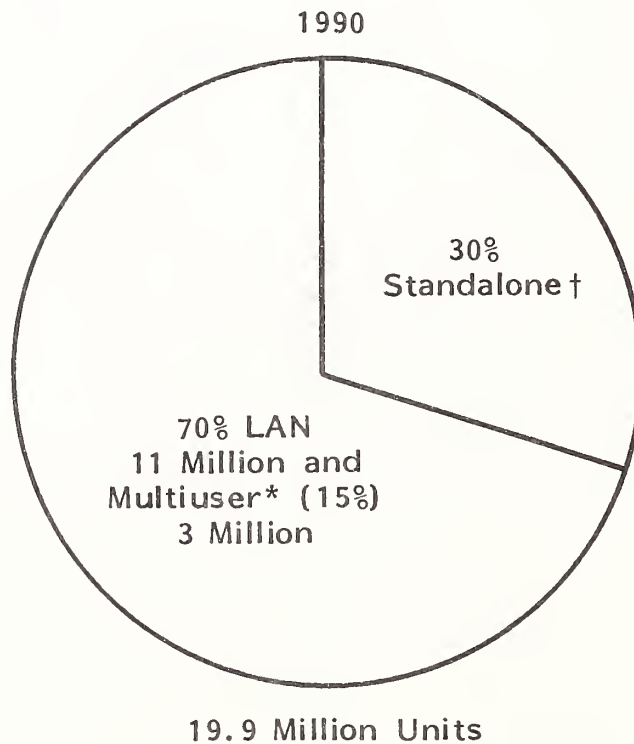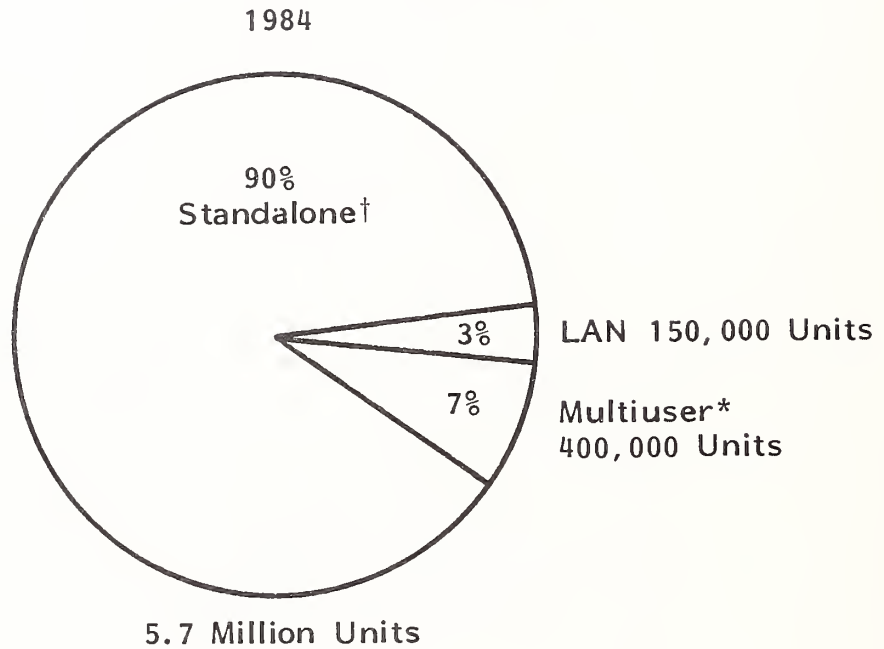
* Multiuser System — Multiple Terminals or Micros connected to host processor that does processing for multiple users - could be a mainframe, mini or micro can serve as the host.

† Standalone Micro — Not physically connected to anything else by wire.

INPUT
MCMM

- From 1985-1990 the installed base of microcomputers in business is expected to grow to 19.9 million units (see Exhibit III-10). A comparable exhibit providing breakdown by large and small businesses is also provided (see Exhibit III-11).

  - In 1990 about 12% (or 2.4 million units) are expected to be linked to a host. This number includes only direct physical links to hosts; therefore, if a large number of microcomputers are in a LAN with a mid-processor microcomputer accessing and distributing host data, only the mid-processor is counted as a link node. Consequently, many more than 2.4 million microcomputers have access to host data.

  - Although these micro-mainframe link numbers may appear low, it is also important to note that INPUT believes connectivity is a very significant office trend--70% of all micros in business are expected to be linked--however, micro-mainframe links are only one way to provide this connectivity (see Exhibit III-9).

  - In 1990 INPUT projects that 85% of microcomputers in business will be used for analytical (primarily spreadsheet) type functions, 15% for operational processing as manufacturing and production. Within the 85% analytical workers would fall modern links and LANs. In the operational category would fall those that needed host information on a very timely and constant basis--data entry and programming people would primarily fit here and direct micro-mainframe linkage would probably be the connectivity method. This assumption leads to support the emulation and intelligent link package projections in Exhibit III-12.

  - Products based on terminal emulation boards and software (including intelligent links) will account for over 80% of the links, and microcomputers with hardwired emulation in ROM (as IBM 3270/PC and DEC micro VAX) will account for the remainder.

INPUT

EXHIBIT III-10

NET INSTALLED BASE OF MICROCOMPUTERS*,
1985-1990
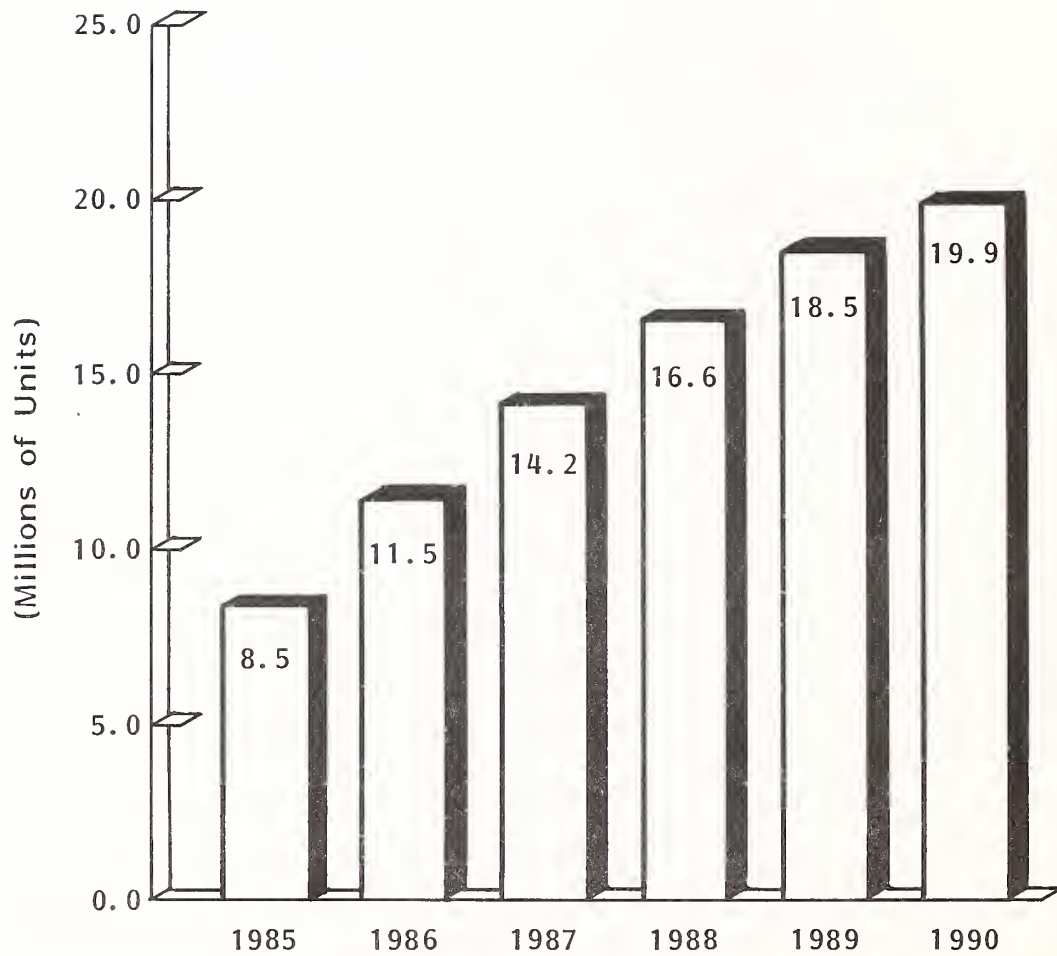
* U.S. sales of microcomputers selling for less than $15,000 that are used for business.

INP
MCMI

EXHIBIT III-11

INSTALLED BASE OF MICROS IN BUSINESS, 1985-1990
(U.S.)

	1983	1984	1985	1986	1987	1988	1989	1990
Total	3.1	5.7	8.4	11.5	14.2	16.6	18.5	19.9
Percent/Businesses over $10 Million Revenues	60%	53%	48%	47%	46%	44%	44%	42%
Units/Businesses Over $10 Million Revenues	1.9	3.0	4.0	5.4	6.5	7.3	8.1	8.6
Units/Businesses Under $10 Million Revenues	1.2	2.7	4.4	6.1	7.7	9.3	10.4	11.3

INPUT
MCMM

EXHIBIT III-12

MICROCOMPUTERS LINKED TO IN-HOUSE
CORPORATE HOSTS
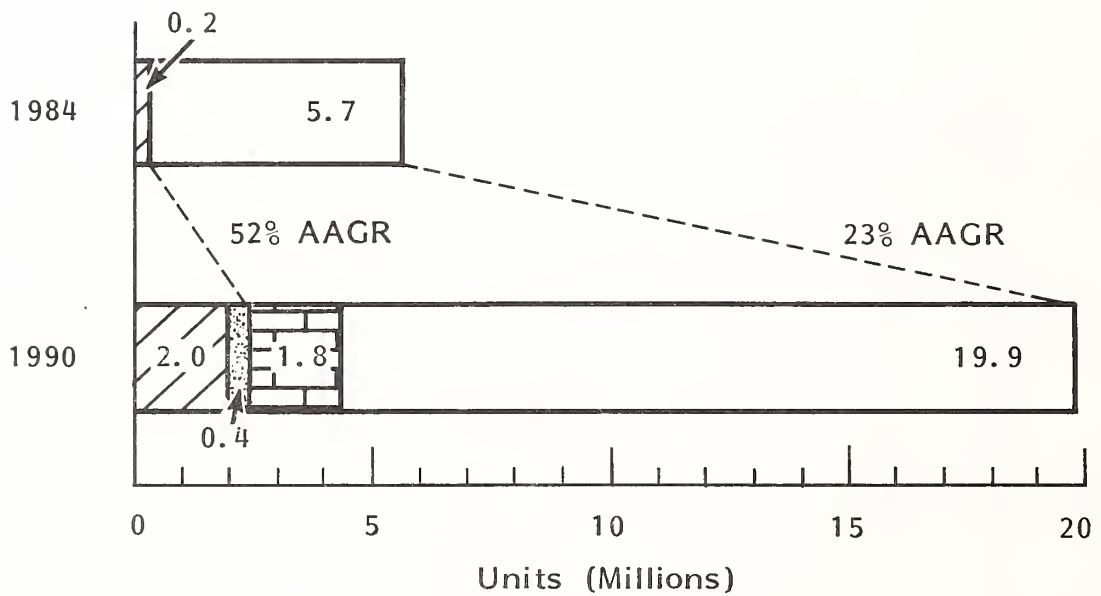
Business Microcomputer Installed Base
1984-1990

Linked Via Emulator

* Linked Via Hardwired ROM (e.g., IBM PC/3270)

* Linked Via Modem-Communication Software

* Note: These segments are both too small in 1984 to make a significant showing on the graph

INP
MCMM

-   Although excluded from this analysis, microcomputer communication software products with modems, whose main use today is linking to public data bases, will increasingly be used to communicate with internal higher order processors. These links, however, will be used on a more casual basis, perhaps accessing mainframes once a week or bimonthly for data.

    .   This "casual" connectivity will increase dramatically, largely because the modem connection does not need a dedicated controller slot per modem (as a terminal emulation board does). A controller can support about eight terminals and is a costly piece of equipment.

    .   These connections could count for as many as 1.8 million units in 1990 and make up a portion of the six million standalone units INPUT projects will be in the business microcomputer installed base in 1990 (see Exhibit III-12).

    .   Most of these "casual" needs for host data can and will be satisfied by a communication server or file server in a LAN environment.

1.   UNITS EMULATORS

●   Emulation packages will continue to decrease in price and by 1990 in many cases will be an integral part of a microcomputer configuration. Shipments will continue to grow at 25% CAGR (see Exhibit III-13).

2.   UNITS INTELLIGENT LINKS

●   Sixteen thousand intelligent links were shipped in 1984. A corporate site configuration generally included a mainframe piece with about ten microcomputer connections. The intelligent link market will have a 56% AAGR, much higher than for emulators as:

INPUT

EXHIBIT III-13

SHIPMENTS OF EMULATION PACKAGES
1984-1990
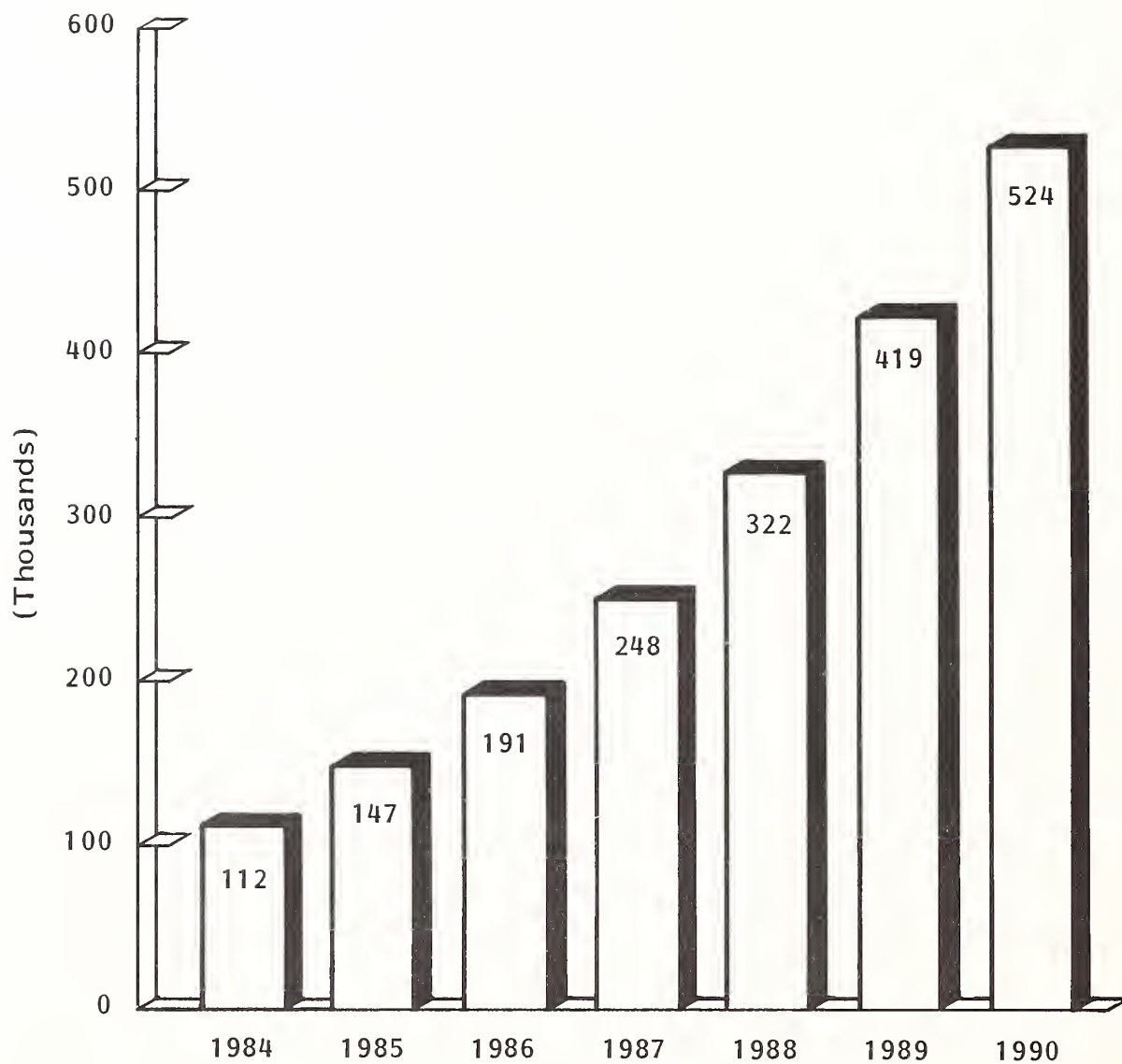
- IS concerns are addressed.

- Easier user interfaces are developed.

- More links will be hooked per mainframe extractor package per site (about 20-30 microcomputers per site). As more microcomputers enter corporations, link usage becomes easier and more accepted for certain types of knowledge workers.

- In 1990, 33% of the direct microcomputer to host links will be intelligent packages, up from 11% in 1984 (this excludes the "casual" modem connections). (See Exhibit III-14.)

  - Negatively impacting the installment of intelligent links will be:

    . More intelligence added to terminal emulator packages at marginal cost.

    . The cost of host extractor package (see pricing section).

    . Increasing use of LANs with modem links.

3. PRICING

- In 1984 prices for microcomputer host links were far from consistent. Packages ranged from less than $1,000 to tens of thousands of dollars.

  - Emulator prices were the more consistent of the two (emulators and intelligent links). In 1984 packages listed for about $1,200-$1,500 but generally sold in quantity for about $800.

INPUT

EXHIBIT III-14

- 42 -

SHIPMENTS OF INTELLIGENT MICRO-MAINFRAME LINKS
1984-1990

INP
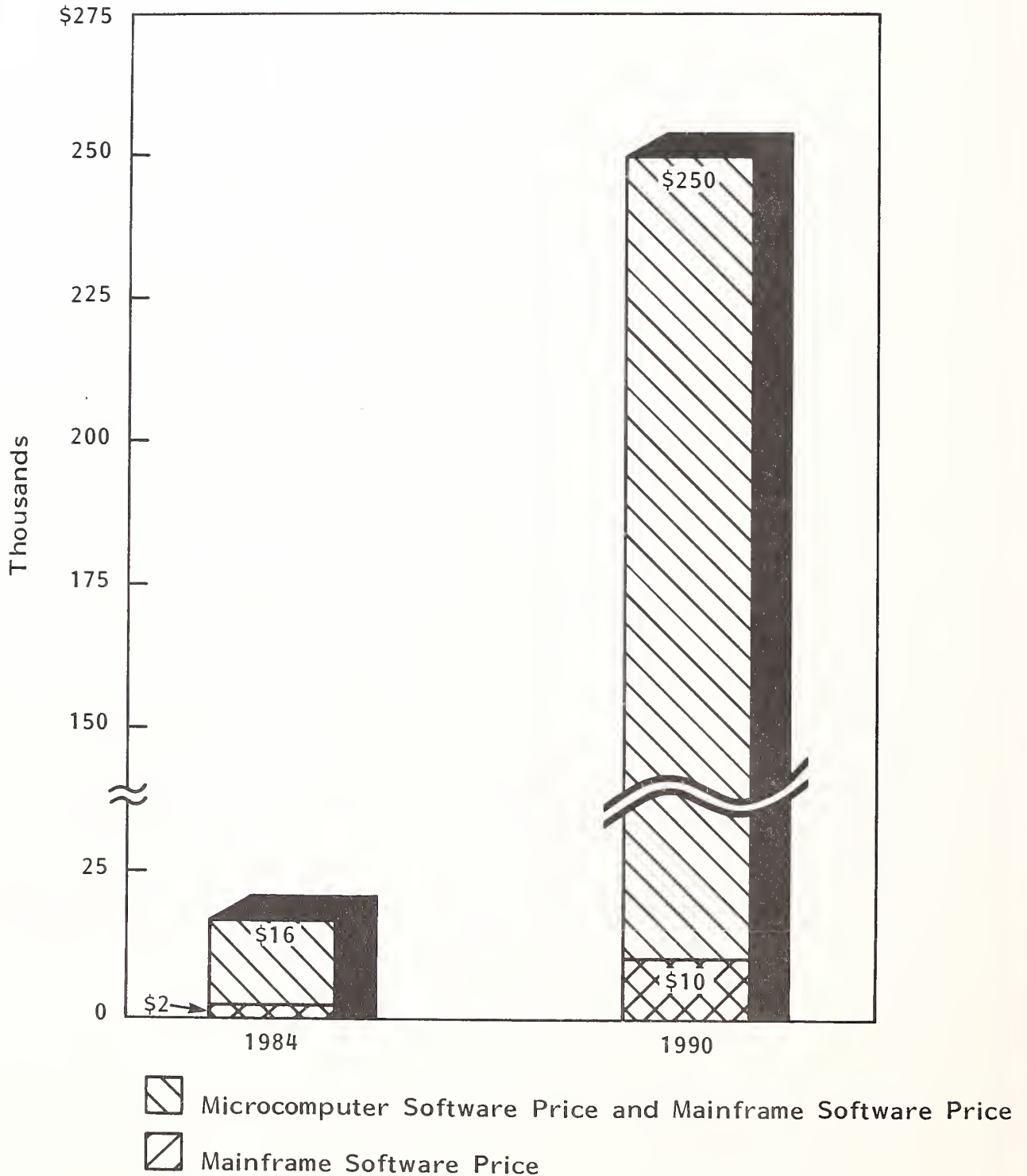
- Due to the decreasing prices caused by advancing technology and competitive forces, the emulator piece is expected to cost about $150-$200 in 1990 (see Exhibit III-15).

- Intelligent links, on the other hand, are priced anywhere from $1,000 to $5,000 per node.

  - The links that extract data base or host application information generally have a host piece (with the extractor) and a microcomputer link piece. Prices are generally $500 per PC link and $45,000 for the mainframe piece, but the price of the host piece varied significantly. With ten microcomputer nodes connected at one site, the average unit price per node is about $5,000.

  - In 1984 a large number of TempusLinks were installed (over seven thousand units)--their cost per node is about $1,000 which significantly lowers the installed base and 1984 user expenditure numbers. More complex and more expensive intelligent links will increase in market share, thereby increasing overall user expenditure projections.

- As with emulators, the microcomputer piece is expected to decrease in price to about $150 in 1990 (see Exhibit III-15).

- The host piece, on the other hand, will either remain constant or increase in price. This will be due to:

  - The micro-mainframe host function will increase in complexity--the overhead will be high for resource sharing, file safeguarding and tracking.

  - The link will be a time sharing file on the host and will repeat at the IS level what timesharing companies had to develop and support in the 1960s.

- 43 -

INPUT

EXHIBIT III-15

AVERAGE UNIT PRICE CHANGES
1984-1990

Emulator Board and Software
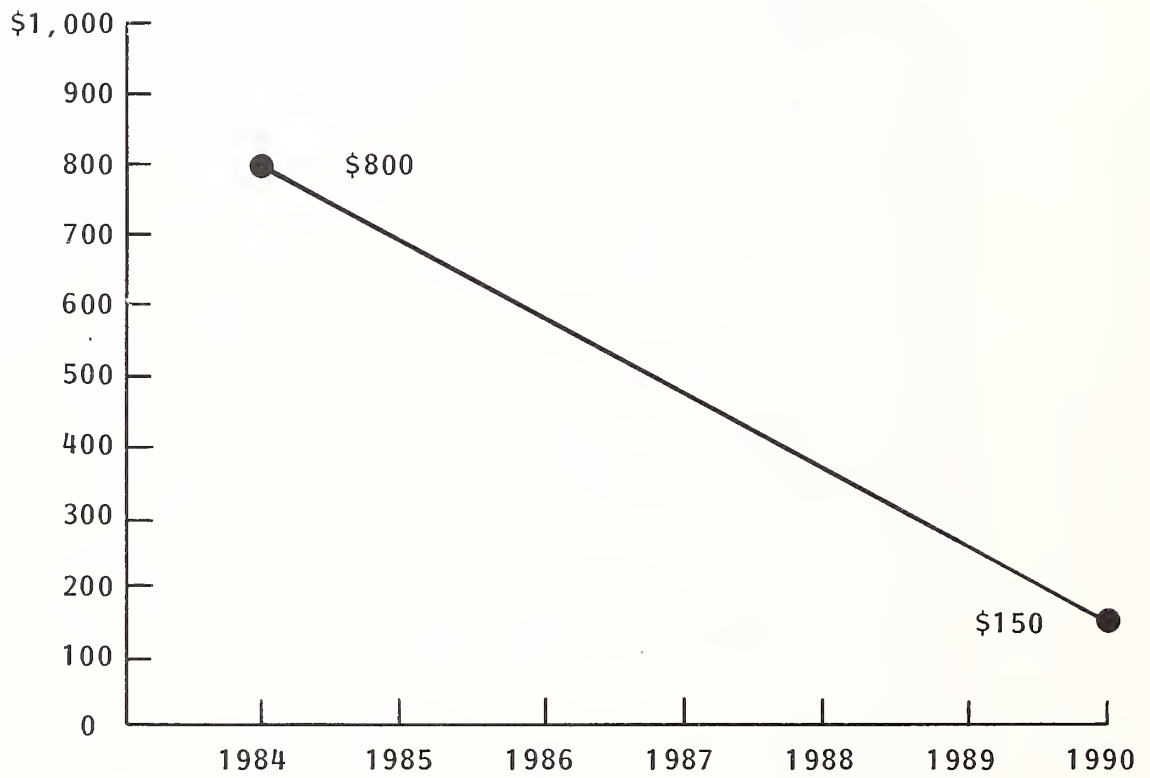
*Includes discounting for quantity sales.

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- Consequently, the host attachment, bundled with extractor, is projected to cost about $50,000 in 1990.

- However, since more nodes will be attached per mainframe link, the average unit cost per node will decrease from $5,000 in 1984 to about $2,000 in 1990 (see Exhibit III-16).

INPUT

EXHIBIT III-16

AVERAGE UNIT PRICE CHANGES
1984-1990
INTELLIGENT LINKS

Host Piece

Microcomputer Piece

INP
MCMM
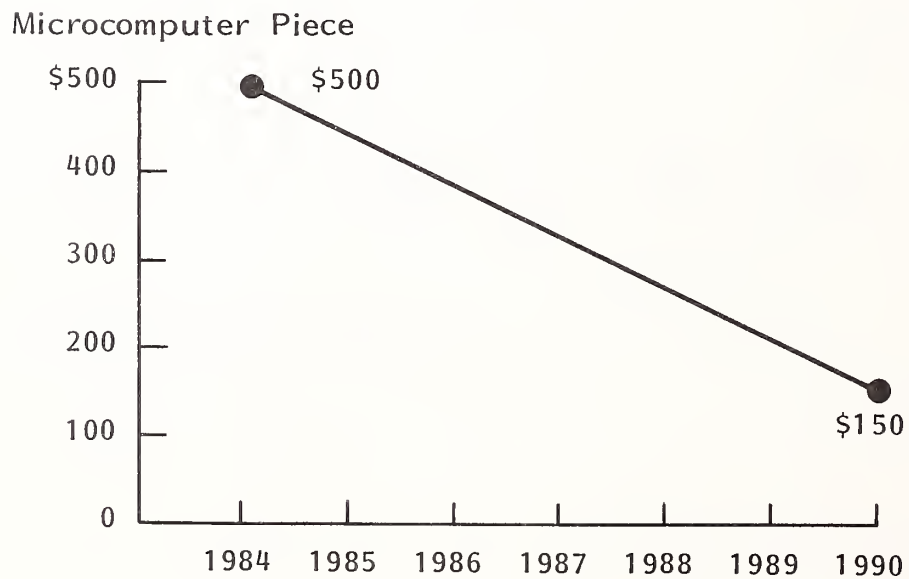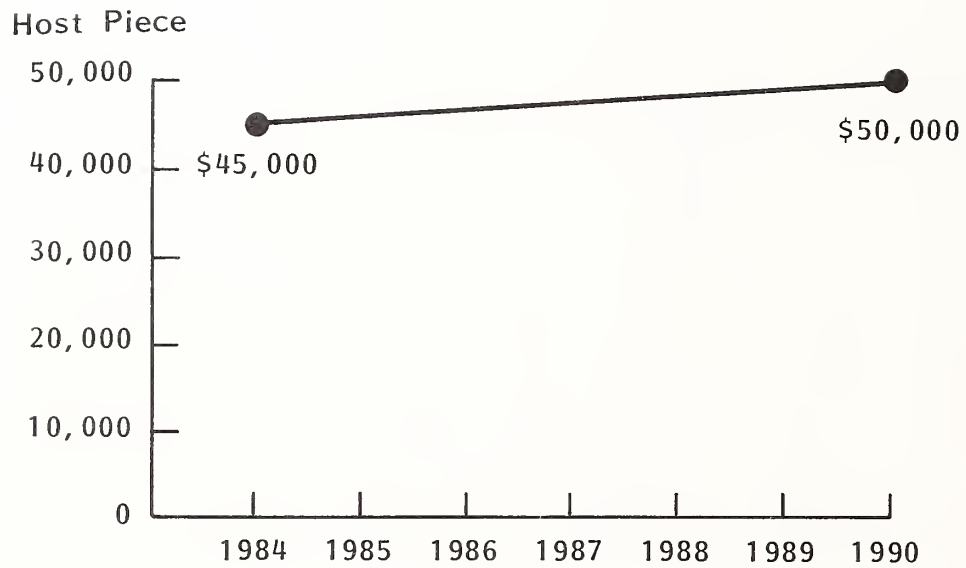
IV INDUSTRY, CORPORATE, AND USER TRENDS

IV   INDUSTRY, CORPORATE, AND USER TRENDS

A.   INDUSTRY

1.   TECHNOLOGY

- As with all other segments of the information services industry, technological changes will impact the micro-mainframe market.

    - The memory storage and processing capacity of microcomputers are increasing. Some observers believe that microcomputers will eventually have as many capabilities as mainframes, both individually and through shared resources on local area networks.

    - Laser disks with economical read and write capabilities, promise increasing local storage capacity. This means that each microcomputer can have a copy of the master data base normally stored on the mainframe.

    - Advances in integrated circuits and the expected 1986 availability of "megachips" capable of storing over one million rapidly accessible bits, promise to bring much of the processing and storage power of mainframes to desk-top units.

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- Integration of voice and data capabilities also indicates a trend to communicating between microcomputers.

- The implications of these technological changes for IS are clear:

  - With the increasing communications capabilities of microcomputers, distributed data base management will emerge as a key IS task. With massive local storage available to end users, how, for example, is concurrency with the central data base insured?

  - What will be the impact on the corporate communications network of these new systems?

  - Indeed, how does IS justify maintaining expensive central storage and processors if every individual or work group has substantially the same capabilities, and is able to communicate freely throughout the organization?

a. <u>Videotex Micro-Mainframe</u>

- Many think of videotex as a new media consumer service. Office videotex, which internally serves corporate information workers, will probably find greater success.

  - IBM, DEC, AT&T, Honeywell, Sperry, and other computer manufacturers are aggressively pursuing office videotex markets.

  - On-line data base services such as Dialog are adding large numbers of new subscribers daily.

  - As use of both internal and external systems increases, so does traffic.

- 48 -

- Videotex is an easily used micro-mainframe data base application. The videotex (front end) processor, located between the end user and the data base, extracts and formats data for display on special terminals or microcomputers equipped with decoder software or boards.

- Although videotex "pages" may need to be composed on frame creation systems, videotex can also present pre-existing mainframe data. Videotex usually implies color graphics, but ASCII-only systems with easy user-interfaces are also available.

- For occasional data base queries by unsophisticated (in a computer literate sense) users, videotex offers attractive benefits which are described in INPUT's 1985 report Office Videotex.

b.   Modems

- Remote access for micro-mainframe sessions can be done through leased lines, but occasional needs do not justify this expense.

- Access through Value Added Networks is an option, but VANs require access through dial-up ports and may not support higher speeds. Accordingly, direct links to the mainframe are often desirable.

- In the past this access was limited to speeds of 1200 bps, but modems supporting dial-up, full duplex 2400 bps operations are now commonly available.

- Further, in 1984, the V.32 standard was approved by the international standards organization CCITT for full duplex, 9600 bps dial-up communications. These may be used for both synchronous or asynchronous communications.

  - Only one vendor currently offers V.32 modems; however, INPUT expects others. V.32 modems offer the advantages of speedy transfers and reduced line charges.

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c.   Local Area Networks

- LANs will increasingly be used for micro-mainframe linkages, as well as to share data and peripherals in work groups.

    - Vendors are starting to take the micro-mainframe tack in their marketing efforts, with LAN communications servers offering an alternative to individual micro-mainframe linkages and the use of intermediate processors.

    - Technological improvements driven by VLSI technology will add flexibility to LANs while lowering prices.

d.   CBX--The "Fourth Generation" Voice/Data PBX

- Compounding any view of micro-mainframe linkages are so-called "fourth generation PBXs," which INPUT refers to as CBXs (computerized branch exchange).

    - These voice/data switches are distributed processors which integrate LANs by design and form the core for office automation and telecommunications in the corporation. There are implications for data processing and micro-mainframe implementations.

    - As the installed base of earlier generation switches become obsolete, CBXs will become more common, bringing with them micro-mainframe capabilities.

    - IS needs to be aware of this approach to merging voice and data functions to aggregate resources in one integrated system designed to ultimately form the central nervous system of corporate information management.

- 50 -

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- However, it is generally believed that CBX linkages support relatively low speeds. This may be adequate for many applications, but for others, unsuitable.

- CBX issues are analyzed in INPUT's 1984 report LAN/CBX Trends: Decision Processes for End Users.

e. Fiber Optics

- Fiber optic links are now being used in some specialized networks, and the use of this medium, both internally and through common carriers, will continue to grow, providing increased integrated voice, data, and image communications capacity.

- As use of this technology grows, equipment such as the interchangeable modems used in today's data communications systems, and other standardized mass produced fiber optic components, will reduce networking costs.

2. IBM DIRECTIONS

- Since the office is largely an IBM world, and since the IBM PC is the de facto industry standard, understanding IBM's intentions and directions is important for determining the direction of the micro-mainframe market.

- IBM strategy is one of office centralization through a hierarchal network (see Exhibit IV-1). Even though there is real need for distributed processing, IBM will resist the concept as long as it can. They fear decentralization would decrease the demand for mainframe mips--IBM's "bread and butter" products. IBM is prepared to support multiple-PC operating systems and an infinite variety of connections to the mainframe--through controllers, small business systems, mid-range mainframes--practically anything except mini-computers, which have a bad connotation for IBM.

- 51 -

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EXHIBIT IV-1

HIERARCHICAL NETWORK

Primary
Functions

Level I
Purchase Price $4,000,000

Large-Scale
System(s)

1. Heavy Computation
2. Transaction Processing against
   Large Data Bases
3. RJE Replacement of Standalone
   Batch Systems

Level II
Purchase Price
<$200,000

Minicomputers

1. Network Control
2. Scientific Timesharing
3. Program Development and
   Maintenance
4. Simple Transaction Processing

Level III
Purchase Price
<$20,000

Intelligent
Terminals

1. Collection, Editing and Display
   of Data
2. Control of Level IV Terminals

Level IV
Price Varies
Significantly

Terminals

1. Data Entry and Display
2. Sensing and Control Devices

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UR20MCI

- They are, however, providing "lip service" to the distributed office concept by providing certain linking products.

    . The Series One is for a type of distributed processing but is primarily being used for terminal servicing.

    . It is more likely that IBM would support distributed processing in large businesses with a 4300.

- IBM will sanction DDP in the 1990s but until then only piecemeal solutions will be provided.

- IBM has identified the general development of communications software as a top priority, but it needs to overcome the past piecemeal development and enhancements made to its family of products.

    - The company has increased its programmimng staff, and will work to enhance Systems Network Architecture (SNA) to serve decentralized needs.

- The success of the PC underscores the strategic importance of micro-mainframe communications software. Its users have often had to look to other solutions in the absence of fully integrated products from "Big Blue."

- To support micro-mainframe, IBM does offer a range of products:

a. Software

- The Personal Decision Series (PDS) of productivity tools links with "Attachment" products to IBM's "Business Management Series" on System/36 and System/370 with access to DOS files and DIF file conversions.

- 53 -

INPUT

- They give users virtual disk sharing options, with conversion between EBCDIC and ASCII, as well as security functions.

- In the future, IBM will need to provide versions of this product that links to other IBM mainframes.

● A low cost ($200) link product is available for its "Assistant Series Software" (licensed from Software Publishing) to access IBM hosts.

● On the hardware side, IBM offers:

- The 3270 PC which allows windowed multiple host access with simultaneous personal computing abilities.

    . Data can be transferred between windows.

    . The 3270 PC communicates with any System 370, 308X or 43XX through a 3274 controller.

- The PC XT/370 and the faster PC AT/370, as the names imply, work as microcomputers, as System/370 VM/CMS workstations, or as 3277 display terminals.

    . Switching between modes is done with a few keystrokes. Data can be downloaded for manipulation, reporting, and program development, and then uploaded back to the host.

● The announcements of the 3270 PC and XT/370 were precursors of IBM's distributed processing strategy.

- Intelligent workstations are made to look like 3270s, and they are permitted to tap into multiple data sources at various levels within the processing hierarchy (remote mainframe, local controller or processor, and/or personal data bases).

- 54 -

- The XT/370 announces to the world that, if you are going to have the processing power of an IBM mainframe (of recent vintage) on your desk, it should look like an IBM mainframe, and be supported by real software--like CMS.

- Both the 3270 PC and XT/370 have two other significant ramifications.

  . They can be used on a standalone basis, but their real justification and "proper use" must be under the great SNA umbrella--progressive integration.

  . Both are designed to put enormous pressure on minicomputers and their functions.

- Early experience with XT/370s has led to some important conclusions:

  - The 12-bit addressing limit and 20M bytes of disk storage places a severe limit on the use of the XT/370 for program development and maintenance.

  - Even compilers tax the storage limit (which is also indicative of how the host software has grown; perhaps some attention should be given to compiler writing again).

  - While the XT/370 may be slow for most things, it does provide more-or-less instantaneous response for editing on the screen. This relates to the proper functions of an intelligent terminal, as defined by INPUT over eight years ago.

- IBM also plans to link the PC network to a future token-ring LAN. While its cabling standard has been announced, the introduction of this LAN has been delayed by software development.

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- IBM has been promoting a set of extensions to SNA, including Advanced Program-to-Program Communications (APPC) and Logical Unit (LU) 6.2 protocols to be used in host-host links, and for pass through to noncompatible devices in the IBM environment.

    - Logical units form the basis for terminal and application communications.

    - By referencing VTAM tables, an LU application determines how to communicate with a terminal.

    - LU 6.2 protocols permit document transfer and central control between distributed nodes in the SNA network, in many cases bypassing the host.

    - LU 6.2 permits microcomputers and minis to work intelligently in a peer-peer, rather than master-slave relationship. The mainframe views the PC as a network resource.

        . In this relationship, applications are working with other applications, hence the APPC label.

        . Currently, LU 6.2 is only supported by a few IBM products.

- Also part of this family of SNA extensions is Document Content Architecture and Document Interchange Architecture (DCA/DIA) software.

    - DIA defines how documents are transported through SNA.

    - DCA describes document formatting.

- 56 -

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- DIA/DCA will become a de facto protocol standard, and other vendors are developing ways to attach non-IBM equipment.

• Other vendors are expected to support these protocols in the future.

• Additional links, particularly between the Distributed Office Support System (DISOSS--a mainframe program supervising large, shared, document files), Professional Office System (PROFs), and PCs are still needed to effectively integrate office automation and data processing functions.

• Further development of micro-mainframe software by IBM is expected, and will be introduced over the next few years, but this delay is undoubtedly causing cautious IS approaches to micro-mainframe linkage.

• The strategic importance of IBM's signaled direction in micro-mainframe links is to redefine the distributed processing hierarchy and eliminate high-performance minicomputer systems operating under reasonably efficient operating systems such as UNIX.

    - Large mainframes will provide centralized control of the network and distributed data bases.

    - Intelligent workstations can be used for program development and maintenance (forget the current XT/370 and VM/CMS limitations--IBM always proceeds carefully in these matters). Intelligent workstations can also be used for simple transaction processing against personal data bases.

    - Scientific timesharing can be split between the workstation and the host.

    - Thus, we have the VM/CP and MVS/XA threads running from the large host mainframe through remote processors (including controllers) to

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intelligent workstations without benefit of significant distribution of processing power (or centralized control) from the host system.

B. END-USER MICRO-MAINFRAME ISSUES

1. SHARED FUNCTIONALITY

- INPUT coined the term "shared functionality" to describe a key characteristic of micro-mainframe applications.

    - Shared functionality is the sharing of processing and data between mainframe and microcomputer.

    - It is allied, but distinct from, older views of distributed data processing.

        . DDP was usually seen as centrally controlled. Shared functionality is based more on equality and peer-peer relationships.

        . A key DDP motivator was IS efficiency. Shared functionality is motivated by meeting end-user needs.

- The concept of shared functionality is accepted by the majority of respondents to the 1985 INPUT ISPS micro-mainframe survey. Some think, however, that micro-mainframe is, or should be, limited to suitably protected mainframe to microcomputer data flows.

    - Respondents were asked if they believed that within five years most applications that are now host-based will have a considerable amount of functionality taken over by personal computers linked to the host.

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- The majority agreed with the statement.

- The findings were consistent with virtually all respondents reporting the planning or implementation of micro-mainframe applications. Although many might be called primitive, they represent experiences which are paving the way for further development.

• Shared functionality also implies decentralization. Respondents were asked to rate the impact of micro-to-mainframe applications on moving their company toward more decentralized information system functions.

- With 1 representing "no impact" of M-M on decentralization and 5 representing "great impact," respondents averaged nearly a 3 rating.

- This compares with an average rating of slightly over two for current decentralization status.

- The shift toward decentralization caused by M-M is shown in Exhibit IV-2.

- These findings are significant in that a company's movement toward IS decentralization impacts the very structure of IS and its reporting roles in the organization.

2. KNOWLEDGE LEVEL OF USERS

• When INPUT studied micro-mainframe in 1984, it appeared that end users had a simplistic perception of the issues involved.

• Since then, the number of computer literate workers has grown, as has the number of microcomputers in the workplace. Also contributing to end-user sophistication are the increasing number of corporate sponsored and third-party microcomputer educational programs.

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EXHIBIT IV-2

M-M IS SHIFTING I.S. TOWARD DECENTRALIZATION

INPUT
UEMM
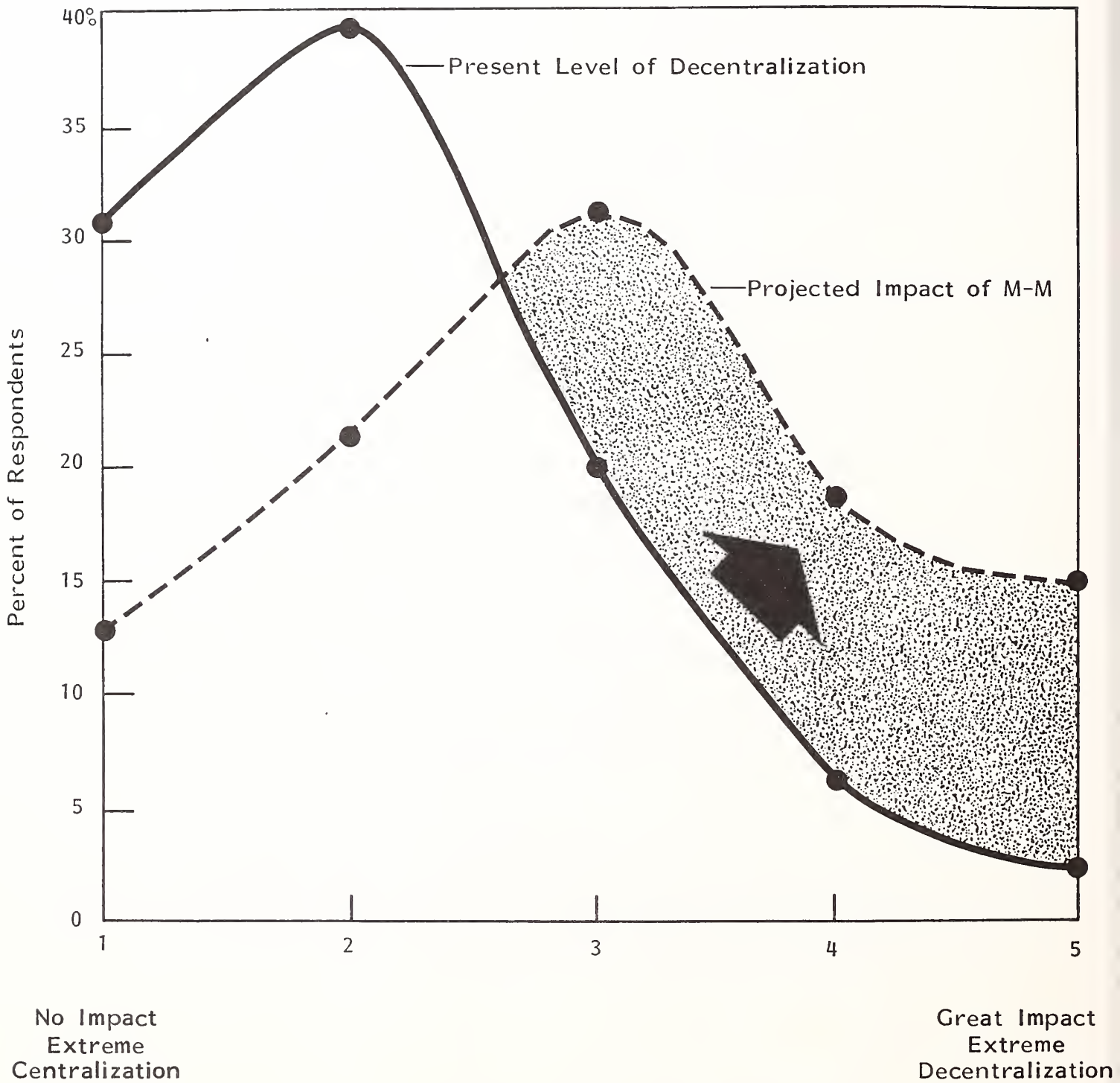
- The increasing number of micro end users are greatly influencing the pressure to implement micro-mainframe links, primarily to improve productivity. Fortunately, with growing microcomputing familiarity comes increasing appreciation of the problems which need to be addressed when implementing micro-mainframe policy.

a.   Functionality Versus Ease of Use

- While advanced, highly capable products are becoming available, many users, not generally familiar with mainframe commands, are finding their functions clumsy. Easier packages are often limited in their capabilities.

b.   Training

- IS personnel are trained to use mainframe software which requires knowledge of an often complex command structure. These methods are generally not "user-friendly" and are unsuitable for most end users.

    - It is for this reason that pure terminal emulation is often an unsatisfactory micro-mainframe method. It requires knowing and understanding mainframe commands.

    - Micro-mainframe packages usually offer a menu driven user-interface (generally easier to use), and some vendors offer on-line training modules with their packages.

    - The future will undoubtedly bring natural language capabilities to micro-mainframe links.

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C. CORPORATE TRENDS AND ISSUES

- INPUT's interviewers also found IS managers and their staffs well-informed about the status of micro-mainframe, and surrounding issues.

- What generally emerged in the 1985 interview program is a picture of growing awareness, but still some uncertainty over directions to take.

  - Some IS departments are taking a cautious approach.

  - INPUT feels this caution represents two things:

    . Awareness of the emotional factors behind the micro-mainframe demands of the end-user revolution.

    . The capabilities and limitations of existing micro-mainframe products. IS managers need more time to evaluate options and to be convinced that the micro-mainframe solutions offered by vendors fit their immediate and future needs.

- However, a cautious approach can backfire and create relationship problems between IS and users. Users may feel IS is "dragging its feet" and protecting its technocracy.

- IS is responding with the appointment of end-user microcomputing managers. Ideally, this liaison acts in a positive, supporting role rather than a punative, controlling one.

1. GRANTING ACCESS

- The IS manager must determine which requests for mainframe access to grant. End users may have acquired microcomputers without IS coordination

- 62 -

INPUT

but justifying mainframe access is a different, more critical issue which cannot bypass IS. For all but casual micro-mainframe linkages, IS involvement is required.

- While the move to connect previously standalone microcomputers to the network is growing, some users will only require shared resources (e.g., printers), or limited office automation applications (e.g., electronic mail) which can be accomplished on a departmental basis or with limited mainframe access.

2. SECURITY

- Security issues surface often during the interviews and at three levels: backing-up data, preventing unauthorized access (e.g., "hackers" or industrial spies), and maintaining the "purity" of the central data base. This latter concern surfaces when users are given the capability to upload revised data to the mainframe.

    a. Back-Ups

- Backing up mainframe data to prevent catastrophic loss is a standard IS procedure: micro-mainframe does not change this requirement. Even the virtual floppy method of micro-mainframe could presumedly build in an automatic back-up mechanism.

- Information downloading and manipulation in end users' micros should also be locally duplicated to prevent loss of effort.

    b. Access

- Generally, micro-mainframe packages integrate with standard password protections supported by mainframe systems. In this regard, there is no difference between terminal and micro access.

- 63 -

INPUT

- The access problem must be handled in a manner similar to those traditionally used: passwords, authorization levels and audit trails. Some micro-mainframe packages build in audit trails automatically based on identifiers embedded in software or chips installed in microcomputers.

    c.   Updating

- Updating the mainframe data base with revised end-user information depends on specific applications and corporate needs.

    -    Many micro-mainframe packages create "shadow" files separate from the "real" mainframe data base. These shadow files can be verified by IS before being passed in batch form to the core data base.

- Other micro-mainframe packages permit real-time updating with varying levels of DP supervision through password authorization.

3.   STORAGE

- Users surveyed expect microcomputer usage to increase mainframe storage requirements by an average of 18% by 1987.

    -    One-fourth of those responding saw no increase needed.

    -    M-M and other increasing demands on storage and processing may lead to the purchasing of faster, higher capacity central processors and ways of off-loading functionality to intermediate processors.

- Exhibit IV-3 shows how users see M-M creating demands for additional computer resources.

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EXHIBIT IV-3

AVERAGE PROJECTED IMPACT OF M-M APPLICATIONS
ON MAINFRAME PROCESSING AND DISK STORAGE DEMANDS

Current Mainframe
Processing Capacity

17%
Increase

1987 Mainframe Processing
Required to Handle M-M

30% of the
Sample Project a
20-30% Increase; 18%
Project no Increase.

Current Disk
Storage Capacity

18%
Increase

1987 Disk
Storage Required
to Handle Mode

25% of the
Sample Project
no Increase Required

INPUT
UEMM
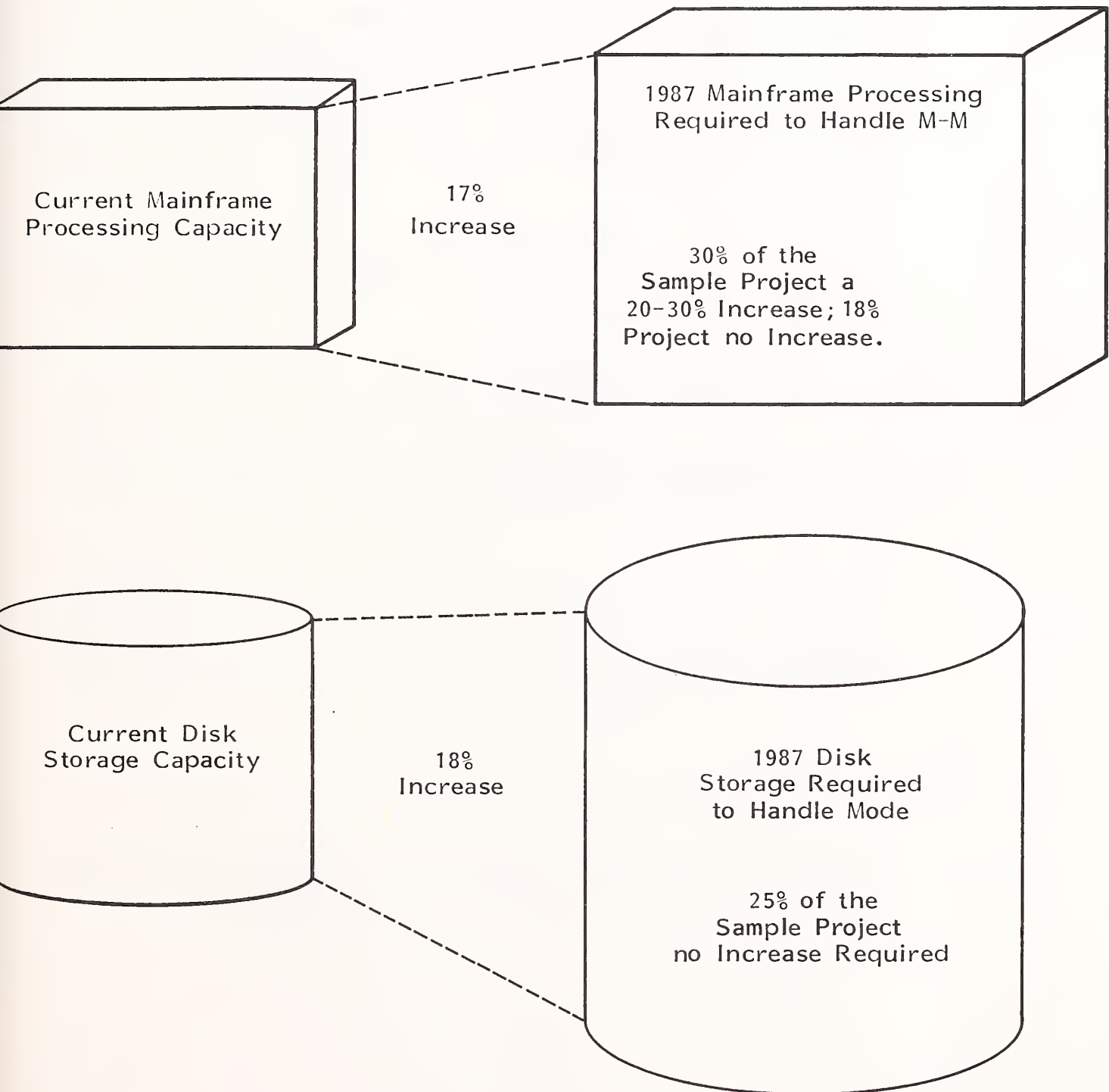
4. IMPLEMENTATION APPROACHES

- Respondents were asked to rate the level of assistance expected from vendors in helping them to plan and implement M-M applications.

    - A majority of the sample indicated low expectations from vendors generally.

    - Microcomputer hardware and software vendors were low rated, but mainframe software vendors rated a bit higher.

    - Remote processing services and turnkey systems vendors received the lowest scores.

    - IBM received the highest rating for expected assistance with M-M implementation.

- Exhibit IV-4 shows the relative ranking of vendors.

- Perhaps more telling is how user organizations plan to construct their M-M applications. The findings show a high level of self-sufficiency.

    - Of three approaches given (modification of existing applications, writing new applications using existing files, and writing both new applications using new files), users in most cases indicate they expect to do their own development.

- The conclusions drawn from these findings are:

    - IS expects to be centrally responsible for developing M-M links and does not have high expectations from vendors working alone.

INPUT

EXHIBIT IV-4

- 67 -

# USER EXPECTATIONS FROM VENDORS FOR PLANNING AND IMPLEMENTING MICRO-MAINFRAME APPLICATIONS

Greatest
Amount of
Assistance*

Least
Amount of
Assistance

- IBM

- Mainframe Software Vendors

- Micro Software Vendors

- Consultants

- Micro Hardware Vendors

- Turnkey System Vendors

- Remote Processing Vendors
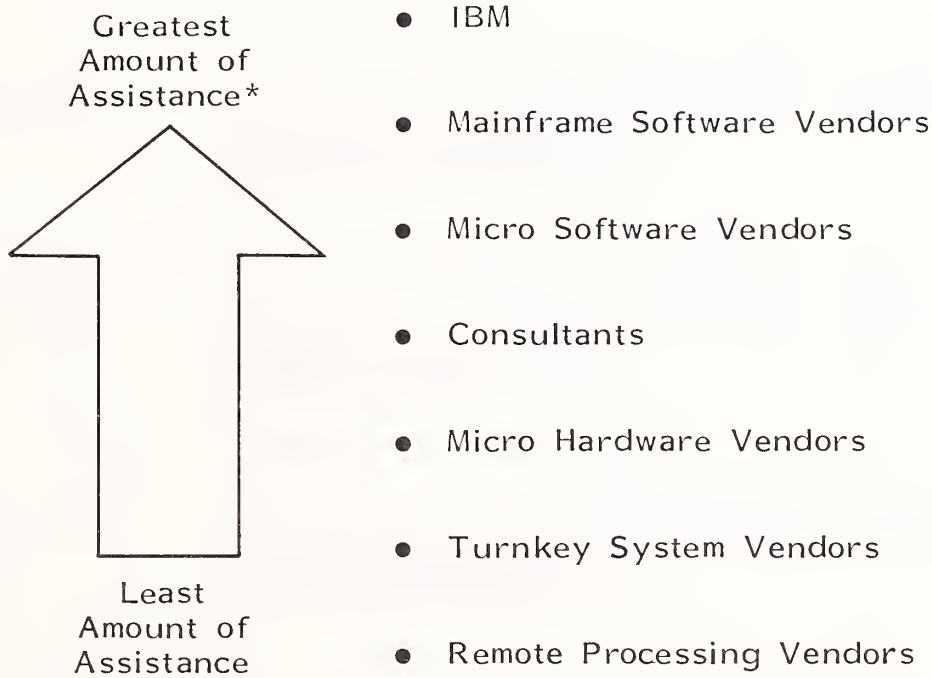
* Based on Average Rating

- 67 -

INPUT
UEMM

- The fairly high rating given joint development indicates that IS expects to buy an established package from a reputable vendor and modify it for the company's specific needs.

- Exhibit IV-5 shows the average scores against the various types of implementations.

INPUT

EXHIBIT IV-5

USER EXPECTATIONS OF VENDOR ASSISTANCE BY APPROACH

APPROACH	USER RESPONSE AVERAGE

Modify Existing Applications — 2.1 / 3.7 / 2.6

Write New Applications with Existing Data — 1.9 / 3.9 / 2.4

Write New Applications with New Data — 2.4 / 3.7 / 2.6

```
    1         2         3         4         5
   Not                                    Very
 Common                                  Common
```
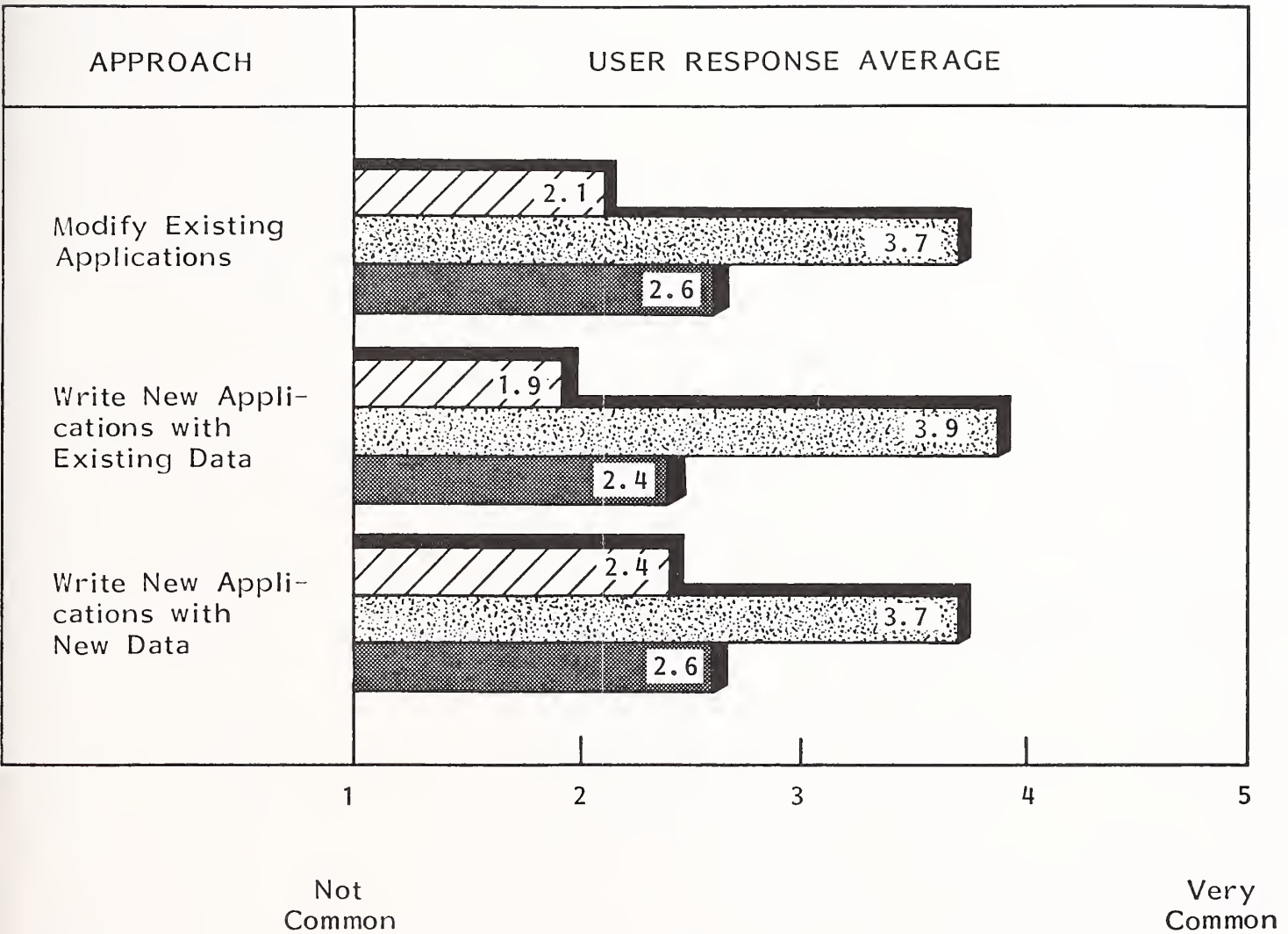
[/] Done Solely by Vendor

[:] Done Solely by User

[■] Done Jointly by both Vendor and User

INPUT
UEMM

V VENDOR ANALYSIS

V   VENDOR ANALYSIS

A.   EMULATOR VENDORS

1.   AST RESEARCH
2121 Alton Avenue
Irvine, CA   92714
(714) 863-1333

- AST's product line includes multifunction and graphics boards, a LAN, and terminal emulation packages.   AST entered the terminal emulation board market in mid 1984.   Their product, whose manufacturing and software rights were bought from CXI, is called PCOX.   An enhanced version with windowing became available in June 1985.

  - PCOX is now distributed through distributors and dealers but AST intends to have 5-10% of 1985 communications revenue to come from direct sales.

  - OEM sales to value added resellers (VARs) as well as distribution agreements with host and microcomputer software vendors are in the discussion stage.

- 71 -

INPUT

2.   CXI INC.
      3606 W. Bayshore Road
      Palo Alto, CA   94303
      (415) 424-0700

3.   DIGITAL COMMUNICATIONS ASSOCIATES
      303 Technology Park
      Norcross, GA   30092
      (404) 448-1400 442-4000

●   DCA is a vendor of all types of data communications equipment. In 1983 it
      acquired Technical Analysis Corporation and its terminal emulation product--
      Irma.

●   The company is working on:

      -    ·   A board with window and network features for IBM's 34/36/38 series.

      -        A joint arrangement with Lotus developing a host interface for
               Symphony.

      -        Similar arrangements with other software companies such as
               McCormack & Dodge.

●   Its joint arrangements will help DCA to remain a leader in the emulator
      market.

INPUT

4. FORTE COMMUNICATIONS INC.
2205 Fortune Drive
San Jose, CA 95131
(408) 945-9111

- Forte Communications Inc. provides a hardware/software solution for terminal emulation. Its base-line product is called Forte PJ.

    - Forte also offers a package that provides on-line mainframe graphics capability to the IBM PC as well as a product called Forte--Call that ties remote microcomputers and terminals located outside the corporate headquarters to a mainframe-based data network.

B. INTELLIGENT LINK VENDORS

1. CULLINET SOFTWARE, INC.
400 Blue Hill Drive
Westwood, MA 02090
(617) 329-7700

- In 1984, Cullinet, the largest vendor of mainframe DMBS Software (IDMS) introduced a new front-end for mainframe data bases designed for easy microcomputer access and an integrated set of microcomputer application packages)--IDB and Golden Gate, respectively (see Exhibit V-1). Golden Gate was a significant announcement but its success up to date has been questionable.

    - As of March 1984 only 5,000 copies of Golden Gate had been sold (as opposed to Symphony units of 45,000 during the same time period) and less than 40% have been linked to the mainframe.

- 73 -

INPUT

EXHIBIT V-1

CULLINET MICRO-MAINFRAME OFFERINGS
(Announced)

```
┌──────────┐   ┌──────────┐   ┌──────────┐
│  VSAM    │   │   IMS    │   │ IDMS/R   │
└────┬─────┘   └────┬─────┘   └────┬─────┘
     └─────────┐    │    ┌─────────┘
          ┌────┴────┴────┴────┐
          │  Extract Utility  │
          └─────────┬─────────┘
                    │
          ┌─────────┴─────────────┐
          │ Information Data Base  │
          └─────────┬─────────────┘
                    │
             3270 Emulation              Host
- - - - - - - - - - - - - - - - - - - - - - - - - -
                    │              Micro
                 IBM PC
```

```
┌───────────────────────────────────────┐
│  ┌───────────────┐   ┌───────────────┐ │
│  │ Relational    │   │               │ │
│  │ Data Base/    │   │  Financial    │ │
│  │ Spreadsheet   │   │  Modeling     │ │
│  └───────────────┘   └───────────────┘ │
│  ┌───────────────┐   ┌───────────────┐ │       ┌─────────────────┐
│  │  Text         │   │               │ │       │ "Trend-Spotter" │
│  │  Processing/  │   │  Graphics     │─┼──────▶│    Graphics     │
│  │  EMS          │   │               │ │       │    Turnkey      │
│  └───────────────┘   └───────────────┘ │       └─────────────────┘
└───────────────────────────────────────┘
```

"GOLDEN GATE"

- 74 -
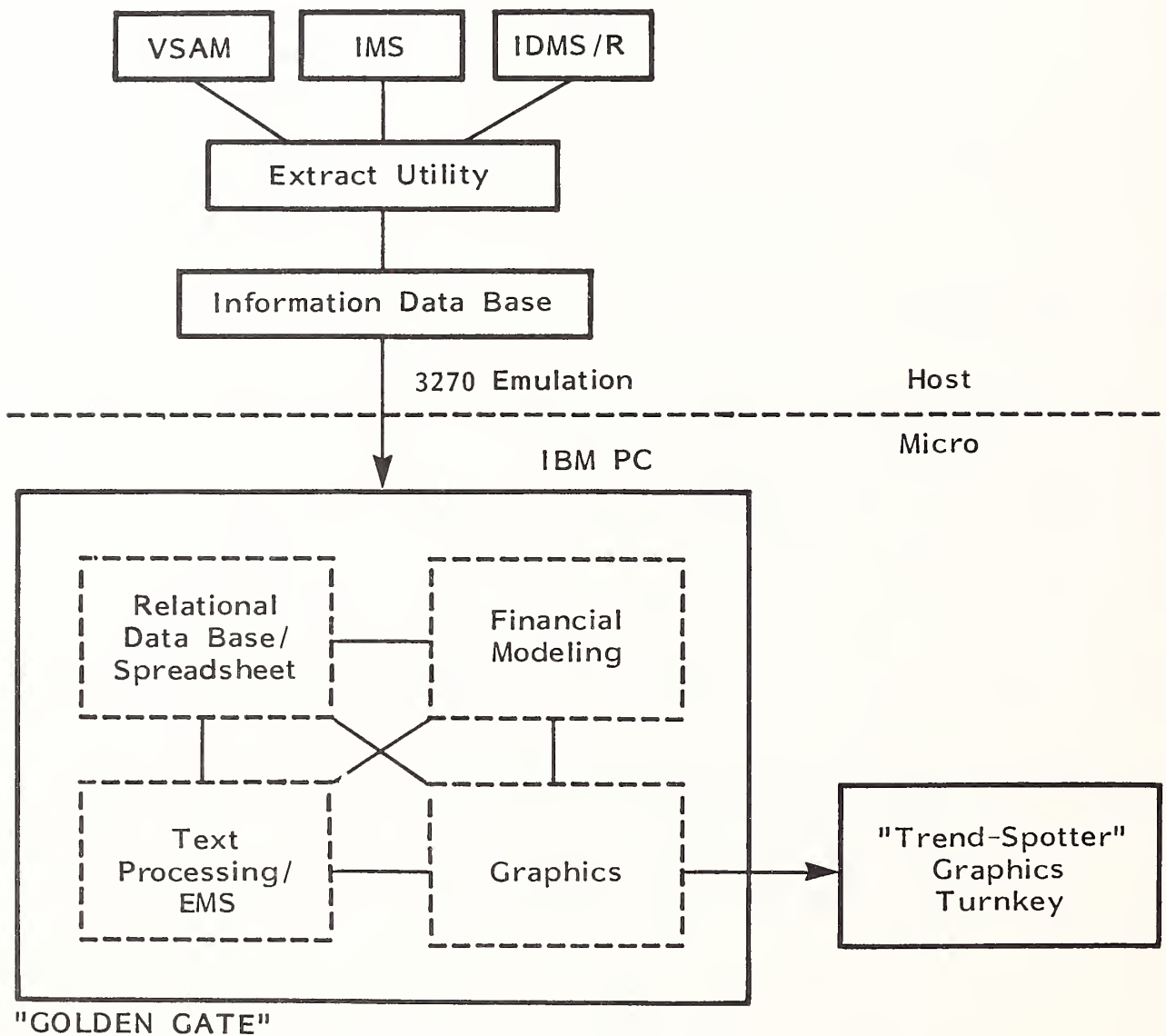
- Central DP staff must set up files to be accessed by Golden Gate users.

• In March 1985 Cullinet announced an alliance with Lotus Development Corporation to develop and market link software.

- The present link offering will be a number of pieces.

    . $150,000 mainframe software program by Cullinet called Information Center Management System (ICMS).

    . A microcomputer piece (Symphony link-Lotus).

    . A mainframe piece (Symphony link--Cullinet).

    . $1,100 in accessories.

- The arrangement will benefit both participants by:

    . Aiding the penetration of Symphony in large corporate accounts where Cullinet is strong.

    . Aid Cullinet in selling its new $150,000 ICMS software.

    . Limit the market to other software vendors for microcomputer links since Lotus and Cullinet are the two leaders.

- However, the strategy has its flaws:

    . The mainframe and microcomputer pieces are on different disks. Distribution of the mainframe piece is direct from Cullinet; the microcomputer piece is distributed in retail stores by Lotus--a large hassle for IS directors.

- 75 -

INPUT

- Cullinet and Hewlett-Packard also recently announced a product to link HP computers to mainframes through IDB.

2. INFORMATICS GENERAL CORPORATION
   21031 Ventura Boulevard
   Woodland Hills, CA 91364
   (818) 887-9040

- Informatics microcomputer link "Answer" services (Visi/Answer, dBase/Answer, Lotus/Answer) work in conjunction with the Informatics Answer/DB on-line retrieval and reporting system. The products select and extract data from a variety of mainframe data base management systems, summarize it, and download it to a microcomputer in usable form. The information can then be used by the microcomputer software package and uploaded to a buffer file where IS can screen the information and then update the host.

  - · Visi/Answer is for use with the Visi series of software; dBase/Answer works with dBase II, III, Friday, and Framework, and Lotus/Answer works with Lotus 1-2-3.

  - The Answer series products are jointly marketed by partner microcomputer companies and Informatics.

  - Both extractor piece ($30,000 DOS or $45,000 OS) and microcomputer piece (about $500 per microcomputer) are sold direct by Informatics.

  - There were about 100 mainframe link installations at the end of 1984.

- The "Answer" series provides much more functionality than most microcomputer links.

INPU

- Informatics strategy is a sound one:

  - Joint agreements with major microcomputer vendors.

  - Direct sales and support to existing client base.

- Exhibit V-2 displays the functioning of an Informatics product.

3. INFORMATION BUILDERS
    1250 Broadway
    New York, NY 10001
    (212) 736-4433

- Information Builders is a leading vendor of a powerful mainframe DBMS and information control system--Focus. In 1981 the company introduced a micro-sized version of their product--PC/Focus. Two years later the company introduced a module called Link to connect the microcomputer and mainframe product.

  - Over 1,000 copies of PC/Focus have been sold but the product and its users are primarily technical.

    . A major advantage of Focus Link is that the end user is not limited to a file that someone in data processing has created-- any Focus data file can be accessed.

  - Information Builders new thrust into the micro-mainframe marketplace aimed at data driven users is PC/FocTalk, a microcomputer level application shell that will access and communicate with any mainframe data base.

    . The company plans to ship 1,000 units in 1985.

INPUT

EXHIBIT V-2

INFORMATICS MICRO-MAINFRAME OFFERING (VISIANSWER)

INPU
UEPM MC
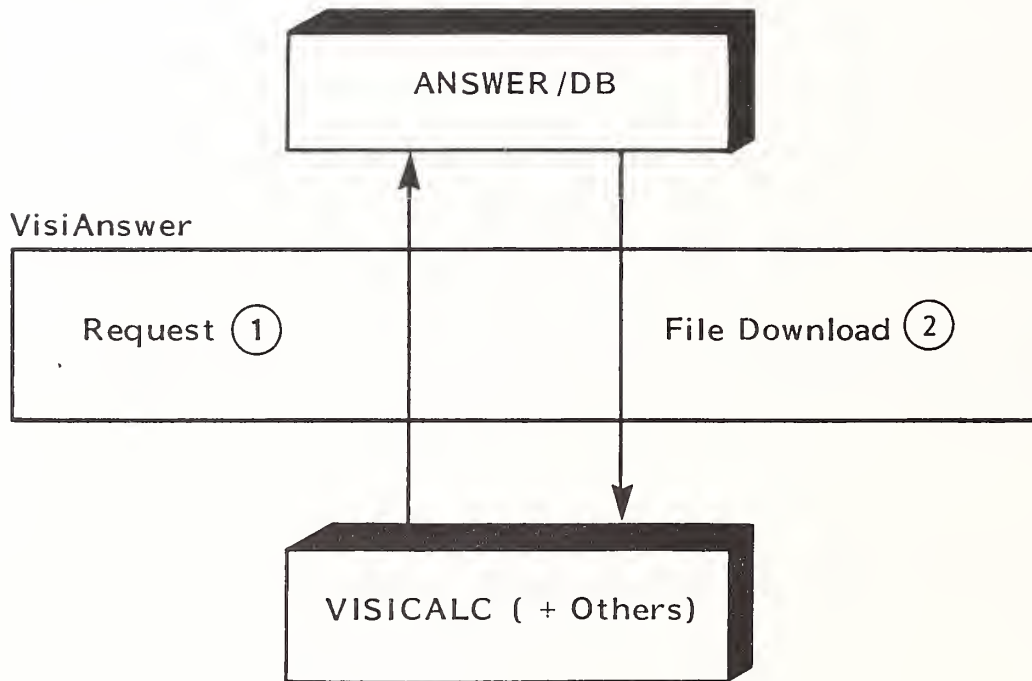
.   Two pieces are necessary for connection--a $450 microcomputer piece and Focus report.

● Information Builders is working at supporting and expanding its host software base with this product strategy. In 1985 it is also producing VAX, Wang, and DOS VSC versions of mainframe Focus with the intention of increasing its market by 1.5 times.

4.   INTERNATIONAL BUSINESS MACHINES (IBM)
Old Orchard Road
Armonk, NY   10504
(914) 765-9600

● IBM's new Personal Decision Series (PDS) provides links between the PC and IBM's office systems. Introduced in late 1984, the attachment part of the package has five software programs that allow the PC and PC XT to communicate with System/370, 30XX, 4300 mainframes, and System 36 processors.

    -    PDS marks the corporation's first major thrust into intelligent micro-to-mainframe links.

    -    PDS includes host- and PC-based software that allows users to use the mainframe as a giant floppy disk to store PC data.

    -    Host data can also be downloaded into the accounting or planning tools contained in the other PDS and Business Management Series (BMS) components.

    -    This approach resembles Cullinet's Golden Gate product which also packages the link with productivity software.

- 79 -

INPUT

- Even though the Personal Decision Series is said to be slightly better than average from a microcomputer software side, it does have IBM's logo and should sell well in corporate America.

• In April of 1985, IBM introduced a new package to tie its Personal Computer Assistant Series into mainframe operations. The Mainframe Communications Assistant allows microcomputer users to access information in most mainframes and transfer it directly to any Assistant Series module.

- The link resides on both the PC and mainframe piece, each piece costing about $200.

- Although the Assistant Series is based on Software Publishing Corporation's pfs: series, the new link product was developed without any input from Software Publishing.

5. MANAGEMENT DECISION SYSTEMS INC.
200 Fifth Avenue
Waltham, MA   02254
(617) 890-1100

• The proprietary mainframe decision support system offering from MDS is called Express; the link offering is called Expressmate.

- Express is a necessary component for file transfer and transition from host to microcomputer software packages.

- MDS plans a microcomputer version of Express (similar to PC/Focus) so data can be downloaded from the host to a PC version with similar format and structure.

- Joint microcomputer software agreements are also in the talking stage.

INPU

6.   MANAGEMENT SCIENCE OF AMERICA (MSA)
     3445 Peachtree Road, N.E.
     Atlanta, GA   30326
     (404) 239-2000

● MSA, a large independent mainframe software vendor, was the first major player to enter the "intelligent" link marketplace in 1982 with Executive Peachpack.

- The product combined six personal productivity titles from MSA's Peachtree Software subsidiary with the menu-driven PeachLink communications program, which allowed host data to be downloaded into the microcomputer applications.

. In late 1984, MSA decided to divest itself of its Peachtree subsidiary, therefore, the product will no longer be available.

. The present 300+ clients of the executive Peachpack will continue to be supported by MSA.

- MSA will retain the rights to the Peachtree Decision Manager Series and will call it MSA-PC software.

. The product will be standalone, with windowing, office automation, and spreadsheet capabilities.

. It will be able to link with another new product, ExpertLink (MSA's core communication product), which will support the MSA-PC software (as well as Lotus, Symphony and other microcomputer software products) for data transfer from any data source--mainframe, Dow Jones, etc.

INPUT

. Expert Link will have passwords for security on the micro-
computer side.

. Cost is about $1,000 per microcomputer with no mainframe
cost.

- MSA is working toward a shared functionality office environment that
uses the microcomputer capabilities and mainframe capabilities to get
to a given point. Its announcement of Distributed PC Applications
highlights this direction. This seems an excellent concept, but imple-
mentation remains farther down the road due to lack of standards and
security as well as unresolved data integrity issues and user needs.

7. MICRO TEMPUS INC.
440 Dorchester Boulevard West
Suite 300
Montreal, Quebec
Canada, H22 IV7
(514) 397-9512

• TempusLink, Micro Tempus Inc's, link product, is based on the "virtual floppy"
concept. It allows the user to access mainframe files as if the files were
floppy or hard drives attached to the microcomputer.

- The product consists of a mainframe link with diskettes for micro-
computers and is priced according to number of users (e.g., five-user
system $6,200; ten-user system $9,800).

- The product does not do terminal emulation (a separate board is
required).

- Passwords for security at different user levels are built in.

- 82 -

INPUT

- The product is generic in that there is no mainframe piece or package necessary, and it can be loaded into any major microcomputer package.

- Pansophic OEMs the Tempus product under the name PANlink.

- TempusLink is exceptionally popular—the company had over $7 million in revenue in 1984.

- The future strategy of Micro Tempus is sound.

    . The product can download microcomputer software for site licensing using DOS commands when microcomputer site licensing becomes accepted (and it will by 1986-1987). Tempus will then also be a viable method of software distribution.

    . The company is developing a new product, Tempus Data—a fourth generation extraction language (price $7,500) to access IDMS, etc. The price difference is significant when compared to Golden Gate at $125,000.

8. MCCORMACK & DODGE
    1225 Worchester Road
    Natick, MA 01760
    (617) 655-8200

● McCormack & Dodge, known primarily for its mainframe accounting software, introduced Interactive PC-link (its micro-mainframe product) in November 1983. The product is one of the more powerful link offerings in that it works with most IBM mainframe software. It downloads to a number of micro-computer software packages and can update (by uploading) McCormack & Dodge financial application software. Exhibit V-3 provides an example.

- 83 -

INPUT

EXHIBIT V-3

McCORMACK & DODGE MICRO-MAINFRAME OFFERING
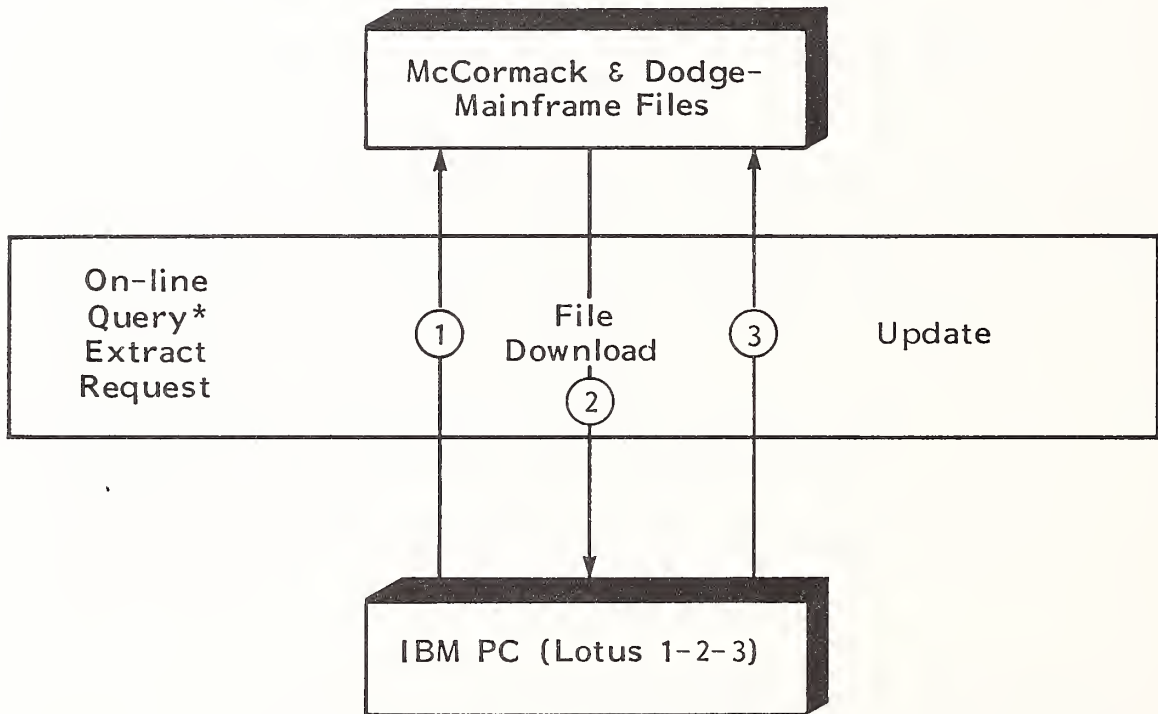
* Non-McCormack & Dodge = Batch Mode

- The product, however, is not as easy to use as many others and costs $25,000 for the host plus $2,500 per microcomputer link.

- Remote transfer capability is available because 85% of McCormack & Dodge potential users cited the need for communicating via remote microcomputer.

9.   ON-LINE SOFTWARE INTERNATIONAL
       Fort Lee Executive Park
       Two Executive Drive
       Fort Lee, New Jersey   07024
       (201) 592-0009

● On-Line Software provides Omnilink, a software link that supports file transfer between the IBM mainframe and the IBM PC. It handles selective downloading to the PC of mainframe data; it also uploads, downloads, and routes files from one PC to another.

- Omnilink was introduced in November 1983 and has about 75 sites installed.

- The product's open architecture does not lock users into mainframe application software or PC software.

- Omnilink represents one of the first generic links to enter the market-place.

- On-Line's promotional emphasis has been to join with other companies that market IBM mainframe compatible packages and that do not have a link product of their own. This approach should work for the company short term by providing link software for vendors who have not acquired or developed a package of their own yet.

INPUT

10. SOFTWARE AG OF NORTH AMERICA
11800 Sunrise Valley Drive
Reston, VA 22091
(703) 860-5050

- System AG is a major mainframe data base vendor (ADABASE). Their link offering is called Natural Link, and was introduced in May 1984.

    - The product is similar to the Informatics offering when used with ADABASE but is completely on-line instead of being a batch utility.

    - When used without Adabase, Natural Link is more like a virtual floppy such as Tempus Link.

    - In July 1985, the company introduced Natural Link--version II with windowing, extended support, conversion to non-standard formats, and · other features.

- Software AG is pursuing joint ventures with microcomputer software vendors but no contracts are signed yet. This, plus looking toward open-ended architecture links not restricted by applications will aid the company's success.

11. OTHER INTELLIGENT LINKS

Company	Product
• Applied Data Research Route 206 and Orchard Road Princeton, NJ 08540 (201) 874-9000	ADR-PC

- 86 -

- Mathematica Products Group   RAM Link
  (now part of Martin Marietta
    Data Systems)
  P.O. Box 2392
  Princeton, NJ   08540
  (609) 799-2600

- Oxford Software   PC Mainframe
  (now part of MMDS)
  174 Boulevard
  Hasbrouck Heights, NJ   07604
  (201) 288-1515

- Linkware   Linkware: Information Server
  77 Rumford Avenue
  Waltham, MA   02154
  (617) 894-9330

- Cincom Systems   PC Contact
  2300 Montana Avenue
  Cincinnati, OH   45211
  (513) 662-2300

- Computer Associates   CA-Executive
  70 Jericho Turnpike
  Jericho, NY   11753
  (516) 997-8800

INPUT

C.   MICROCOMPUTER VENDOR COMPETITORS

- Several major microcomputer vendors are taking an increasingly active role in micro-mainframe linkage. Two such companies are Lotus and Ashton-Tate.

  - Lotus (as mentioned in the Cullinet and Informatics profiles) is pursuing joint agreements with major mainframe vendors. The two aforementioned companies are the first of many significant similar arrangements to follow by Lotus. The company is also known to be internally working on their own link product, which, considering Lotus's corporate success with 1-2-3, should have a good chance of success. However, Lotus does not yet have a direct sales force or a reputation for service and support--two major keys to developing IS accounts.

  - Ashton-Tate's product arrangement with Informatics is a significant piece of the company's corporate thrust in 1985. Ashton Tate is training dealers on its link capabilities while meeting with other mainframe vendors for future ventures. Microcomputer software products will have a microcomputer mainframe "link" built into the product which a separate micro-mainframe link could attach to with little difficulty. This strategy will accommodate various mainframe link products.

- In general, microcomputer vendors are less likely than mainframe software vendors to succeed in the micro-mainframe market.

  - They are generally unfamiliar with the mainframe market (their scope is limited).

  - The industry is splintered; there are few companies with enough time, money, and talent to undertake a project in the mainframe world.

INPUT

- Large corporations tend toward central volume purchases--direct sales; microcomputer software vendors deal through dealers and distributors.

- Mainframe vendors can provide full service, "one-stop-shopping" to customers--a mainframe package, service, and microcomputer packages such as Golden Gate.

- Consequently, only those large microcomputer software vendors who form joint alliances with mainframe vendors or are acquired by mainframe vendors, as Sorcim/IUS was by Computer Associates International, have any chance for success.

D. OTHER HARDWARE VENDOR DIRECTIONS

- Other vendors are not oblivous to the growing demand for micro-mainframe.

  - Digital Equipment Corporation offers integrated terminal emulation, file transfer and Ethernet communications capabilities on the MicroVAX I personal computer, which operates under modified versions of VMS and UNIX.

  - Data General's product line includes microcomputers with integrated communications capabilities operating under its own operating systems. These can emulate both their own, and IBM terminals.

- 89 -

INPUT

VI CONCLUSIONS, RECOMMENDATIONS, AND OPPORTUNITIES

VI CONCLUSIONS, RECOMMENDATIONS, AND OPPORTUNITIES

A. CONCLUSIONS

- The micro-mainframe link market is just one segment of the overall office connectivity market.

    - Companies will utilize a mid-product (such as a mini) between the host and PC users to accommodate and coordinate microcomputer and mainframe access--rather than employing direct microcomputer to mainframe links.

    - LANs will also increase in popularity, affecting the micro-mainframe linkage market potential.

    - The market will continue to have significant growth but does not offer broad opportunities to a large number of present or future participants.

- The micro-mainframe market in 1985 is one of confusion.

    - Lack of product and communication standards.

    - Lack of consistent micro-mainframe product pricing.

    - Lack of leading vendors.

    - Lack of standard function.

INPUT

- The market is analogous to the independent mainframe package software market, having no set price and support. As with that market, the micro-mainframe link market will too evolve, and standards in technology, function, and price will develop.

- Mainframe software vendors will be the leaders in the link marketplace but will form joint agreements with board vendors (such as DCA) and micro-computer software companies for complete linkages. The intelligent links will continue to be marketed primarily either separately or as an ingredient in a mainframe vendor's corporate package, but some vendors will incorporate the link as a part of the application or data base package.

- Future intelligent link packages will be "generic link" products going from specialized data bases to any number of microcomputer products.

- Intelligent link products will:

  - Have easy to use user interfaces.

  - Be transparent in accessing data.

  - Incorporate artificial intelligence and voice recognition.

- Mainframe and mini vendors will provide a type of link solution by having desktop machines that will supercede protocol converters and file formatters and use the same software as hosts (XT-370 runs VM (CMS) and PC DOS, Micro VAXI runs modified but fully compatible versions of ULTRIX and VMS, and UNIX System V products are portable across hardware product type).

- The micro-mainframe market is user driven.

  - Users want access to host data to increase their productivity.

INPUT

- Real-time data is a user cry; however, only in rare cases is it necessary (production, air traffic control). What users really need is "more timely data."

- There will be no updating of the mainframe data base without the blessing of IS.

- IS role is turning into solution oriented and away from tools and development.

  - IS is being called on increasingly for end-user training and support, especially in the area of micro-mainframe.

  - The fear of "data security" by IS directors has been overemphasized and in some cases used as an excuse to prevent mainframe access. Host DBMS products provide security to links by their own data dictionary, and commonly implemented 3270 terminal security procedures can be used for other applications.

  - Security is an issue at the extract level, therefore security must be built in at this level rather than in link.

- DDP will affect the micro-mainframe market.

  - Distributed Data Processing (DDP) will evolve with advanced application program-to-program communications. PC applications will communicate with mainframe applications.

  - Mainframe software will be modified to take advantage of distributed processing on microcomputers. New technology will make on-line capability on the mainframe less important.

- Standards will develop microcomputer hardware standards (IBM compatible) and network (communication) standards. The standards will primarily evolve around IBM products and strategy.

INPUT

- During the forecast period significant price decreases will occur for emulators and PC link attachments due to technology advances and competition. The host attachment link with extractor is expected to stay constant in price or increase due to an increase in host function and overhead that will be associated with resource sharing, file safeguarding, and tracking.

- 3270 terminal vendors will be affected by the influx of microcomputers into the office with emulation capabilities. However, there will continue to be a need for specialized terminal products, primarily due to increased speed efficiency and decreasing cost. By 1987 major vendors will have terminals available for about $500. Already terminal vendors are building intelligence into their products which tends to blur the microcomputer/terminal distinction.

- IBM will significantly impact the micro-mainframe market.

- IBM will "make it easy" to get to its Personal Decision Series microcomputer software packages not just by "The Attachment" mainframe link but also from all levels of office computers (i.e., minis, controllers, LAN).

- IBM will provide horizontal links to various data bases; independents will sell intelligent links to individual packages.

- Micro-mainframe links will tie into SNA to allow loading of entire control blocks.

INPUT

B. RECOMMENDATIONS AND OPPORTUNITIES

I. VENDORS

- Joint ventures are a key. Since micro-mainframe linkages combine a number of differing products and technologies, a total solution approach will provide the widest opportunities.

    - The emulator company will provide the physical link.

    - The communications company will provide the communications component.

    - The microcomputer software vendor will provide the user-friendly microcomputer link piece.

    - The mainframe software vendor (not known for user-friendly applications but for technically complex products with security features) will provide the host.

- Service, support, and total product distribution should be provided by the mainframe software vendor.

    - Mainframe software vendors already have an excellent reputation for service and support.

    - Their national sales networks are already established with corporate accounts to shorten the sales cycle. IS directors will not want to purchase one piece of a micro-mainframe link from each type vendor (or computer retail store) as is the case with many link packages today.

- 95 -

INPUT

2.   MICROCOMPUTER VENDORS

- Major microcomputer software vendors should include a "hook" price as part of their typical package configuration, to which a separate link piece could be attached. Having a link piece built-in would limit chances for attaching to a variety of link products provided by other vendors.

- Those microcomputer vendors interested in being considered as link candidates should adopt some type of site licensing arrangement to increase the installed base of their software products in business. The larger the installed base of products, the greater the potential for linkage.

- There is a growing opportunity for DDP microcomputer products--products that would be segments of a mainframe application but would offload some of the processing from the host. An example would be an order entry package for a host order entry system or a policy update package for insurance companies that could be uploaded to a policy management system. Joint ventures with host software vendors such as MSA, Execucom, McCormack & Dodge, and PMS are possible.

- In this same vein, packages or utilities could be developed with service bureaus to remotely link microcomputers with their data bases and transmit data. Companies such as Control Data Corporation and Comshare, Inc. are already working in these areas.

- Microcomputer communication software vendors may also consider joint ventures. A case in point is Communications Research Group Inc.'s BLAST file transfer utilities, which has a joint marketing and distribution arrangement with Data General and Data General's CEO office automation system.

INPUT

3. MAINFRAME SOFTWARE VENDORS

- Besides joint ventures with other types of link companies another possible strategy to take in the micro-mainframe area is acquisition. Although the jury is still out on this strategy a case in point is Computer Associates International.

    - CAI is one of the largest independent producers of mainframe software, specializing in data bases and programmer utilities.

        . In 1983-1984 the company acquired two microcomputer software companies--IUS and Sorcim--one a leading vendor of word processing software (IUS-Easy Writer), the other a leading vendor of spreadsheet software (Sorcim-SuperCalc).

        . A new product, CA-Executive, is an integrated spreadsheet package meant to link microcomputers to the mainframe via a windowing program.

        . CAI now offers the IS department a significant selection of well-known quality products for both microcomputer and mainframe environments.

        . MSA utilized the same strategy and acquired various microcomputer software companies. It did not, however, enjoy great successes and decided in late 1984 to sell off its microcomputer subsidiaries.

4. OPPORTUNITES FOR OTHERS

- The installation of micro-mainframe links will increase the demand for independent consultants.

INPUT

-   Near term there will be multiple link products at one site therefore the need to "put it all together."

-   Many host data bases are custom designed; therefore, link products will need to be custom packages also.

INPUT

APPENDIX A: MICRO-MAINFRAME USER
QUESTIONNAIRE

APPENDIX A

MICRO-MAINFRAME USER QUESTIONNAIRE

1. With 1 representing "disagreement" and 5 representing "agreement", to what extent do you agree that "within five years most applications that are now host-based will have a considerable amount of funtionality taken over by personal computers that are linked to the host."? Why?

    _____

    _____

2. INPUT is defining "on-line batch" micro-to-mainframe linkages as those linkages where the micro performs processing on a standalone basis and, periodically, the micro and the host exchange data. The host may then futher process the data received.

    Given this definition, do you believe that links between host computers and micros will be predominately interactive, predominately on-line batch, or about the same?

    _____ Predominately interactive

    _____ Predominately on-line batch

    _____ About the same

    Why? _____

    _____

3. a. With 1 representing extreme centralization and 5 representing extreme decentralization, how would you rate your information systems function?

        _____

    b. With 1 representing "no impact" and 5 representing "great impact", how would you rate the impact of micro-to-mainframe applications on moving a company like yours toward a more decentralized information systems function? _____

        Why? _____

        _____

INPUT

4. a. With 1 representing "no assistance" and 5 representing "much assistance", how much assistance do you expect to be able to get from vendors in helping to plan and implement your organization's critical micro-to-mainframe applications? _____

b. More specifically, how would you rate: (1-5 with 5 good)

VENDOR TYPE	RATING
IBM	_____
Microcomputer hardware vendors	_____
Software vendors who primarily offer mainframe software	_____
Software vendor who primarily offer micro software	_____
Remote processing (timesharing) vendors (e.g., McAuto, Boeing)	_____
Turnkey systems vendors	_____
Professional services and consulting firms	_____

Next, I am going to describe several approaches for contructing micro-to-mainframe applications and I would like you to rate each on a 1 to 5 scale with 1 representing "not common" and 5 representing "very common".

5. The first approach I would like you to rate concerns . . .

a. . . . .modifications of existing applications systems.

1.) How common do you think modifications of this type will be done solely by the vendor? _____

2.) How common do you think modifications of this type will be done solely by in-house information systems staff _____

3.) How common do you think modifications of this type will be done jointly by vendors and in-house information systems staff _____

b. . . . writing new applications that use existing and data base(s):

1.) How common do you think modifications of this type will be done solely by the vendor? _____

2.) How common do you think modifications of this type will be done solely by in-house information systems staff? _____

3.) How common do you think modifications of this type will be done jointly be vendors and in-house information systems staff? _____

INPUT

5. Finally, I would like you to rate the approach that concerns. . .

    c. . . .writing new applications that use new files and data base(s):

        1.) How common do you think modifications of this type will be done solely by the vendor? _____

        2.) How common do you think modifications of this type will be done solely by in-house information systems staff? _____

        3.) How common do you think modifications of this type will be done jointly by vendors and in-house information systems staff? _____

6. a. For your own organization, what specific applications do you see as being the most suitable as micro-to-mainframe applications? (They need not be computerized applications now.) (Use work space below.)

    b. Are these applications planned and if so, at what stage are you implementing them? (Planning stages: no concrete plans, planning, applications being developed, applications already implemented.)

    c. Do you expect to develop these applications in-house, purchase an existing package from an outside vendor, or modify in-house an existing package?

CODE	APPLICATION NAME	STAGE: NONE	PLAN	DEVL.	IMPL.	SOURCE: IN-HOUSE	VENDOR	BOTH
_____	1. _____	____	____	____	____	____	____	____
_____	2. _____	____	____	____	____	____	____	____
_____	3. _____	____	____	____	____	____	____	____
_____	4. _____	____	____	____	____	____	____	____
_____	5. _____	____	____	____	____	____	____	____

Comments:

1. _____

2. _____

3. _____

4. _____

5. _____

INPUT

7. a. In order of importance, with the first being the most important, what do you consider to be the top three problems solved or alleviated by micro-to-mainframe systems?

<u>CODE</u>

1. _____ _____

2. _____ _____

3. _____ _____

b. In order of importance, with 1 being the most important, what do you consider to be the top three problems caused by micro-to-mainfram systems?

1. _____ _____

2. _____ _____

3. _____ _____

c. What can your organization do to solve each of these problems?

1. _____ _____

2. _____ _____

3. _____ _____

d. What can vendors do to solve each of these problems?

1. _____ _____

2. _____ _____

3. _____ _____

On a scale of 1 to 5, with 1 = low importance and 5 = high importance, How important will it be for . . .

8. a. . . . your company's micros to be connected with mainframes within your company? _____. Why this rating? _____

_____

What type of communications linkage would you most likely use for this situation?

_____ Local Area Network   _____ Dial up

_____ Leased Lines   _____ Public Data Network   _____ WATS

_____ Other _____

INPUT

8. b.   . . . the same micro to link to more than one brand of mainframe
         at different times? _____ . Why this rating? _____

         _____

         What type of communications linkage would you most likely use for this
         situation?
                                        _____ Local Area Network   _____ Dial up

         _____ Leased Lines   _____ Public Data Network   _____ WATS

         _____ Other _____

How important will it be for . . .

     c.   . . . your company's micros to be connected with micros in other
          departments? _____ . Why this rating? _____

          _____

          What type of communications linkage would you most likely use for this
          situation?
                                        _____ Local Area Network   _____ Dial up

          _____ Leased Lines   _____ Public Data Network   _____ WATS

          _____ Other _____

     d.   . . . your company's micros to be connected with mainframes in other
          companies? (e.g., subsidiaries', suppliers', or customers') _____ .

          Why this rating? _____

          _____

          What type of communications linkage would you most likely use for this
          situation?
                                        _____ Local Area Network   _____ Dial up

          _____ Leased Lines   _____ Public Data Network   _____ WATS

          _____ Other _____

     e.   How important will it be for your company's mainframe to be connected
          with micros outside of your company? _____ . Why this Rating? _____

          _____

          What type of communications linkage would you most likely use for this
          situation?
                                        _____ Local Area Network   _____ Dial up

          _____ Leased Lines   _____ Public Data Network   _____ WATS

          _____ Other

INPUT

9. a. What telecommunications operating system(s) do you have?

_____ TSO   _____ CMS   _____ CICS   _____ IMS DC

Others: _____

b. Which of these will require micro links by 1987?

_____ TSO   _____ CMS   _____ CICS   _____ IMS DC

Others: _____

10. a. What data base management systems do you have?

_____ IMS   _____ IDMS   _____ ADABAS   _____ TOTAL

Others: _____

b. Which of these will require micro links by 1987?

_____ IMS   _____ IDMS   _____ ADABAS   _____ TOTAL

Others: _____

11. a. Do you expect microcomputer use in your company to accelerate the use of mainframe-based relational data base management systems in your company?   _____ YES   _____ NO (If NO, skip to next number)

b. Which one(s)? _____ DB2   _____ MDBS III   _____ BASIS

Others: _____

INPUT

12. a. Do you expect microcomputer use in your company to _____ Increase _____ have no effect on _____ Deacrease your mainframe processing requirement by 1987?

   As a percentage of your current mainframe processing capacity, what percentage change do you expect in mainframe processing demand to result from microcomputer use by 1987? _____%

   b. Do you expect microcomputer use in your company to _____ Increase _____ Have no effect on _____ Decrease your mainframe disk storage requirement by 1987?

   As a percentage of your current mainframe disk storage capacity, what percentage change do you expect in mainframe disk storage demand to result from microcomputer use by 1987? _____%

(For Number 13, 13a. should equal the sum of 13b, 13c, and 13d)

			NUMBER INSTALLED NOW	NUMBER BY 1987
13.	a.	How many micros do you have total in your company now? 1987?	_____	_____
	b.	How many of these are used as standalone units now? 1987?	_____	_____
		1) How many Local Area Networks do you have now? 1987?	_____	_____
		2) How many of these LANs have communication links to a mainframe or minicomputer now? 1987?	_____	_____
	c.	How many of your micros are used in Local Area Networks now? 1987?	_____	_____
	d.	Excluding those micros used in LANs, how many of your micros are connected to a mainframe or minicomputer now? 1987?	_____	_____

14. Of all your micros which are connected to the mainframe, about what percent are used solely for terminal emulation now?   1987?

   _____% Now   _____% 1987

INPUT

15. Of all your micros, about what eprcent are in use by computer professionals versus "end-users"?

    I.S. Professionals _____% + End Users _____% = 100%

16. a. Do you have any multiuser microcomputer systems? _____ YES _____ NO
       (if no ask for 1987)

    b. How many multiuser microcomputer systems (e.g., AT, Altos) do you now have installed? How many do you expect to have installed by 1987?

       Now _____   1987 _____

    c. How many multiuser microcomputer systems have communications links to a mainframe or minicomputer? How do you expect will have links by 1987?

       Now _____   1987 _____

17. On a scale of 1 to 5 with 1 = "Low importance" and 5 = "High importance", how important do you see UNIX-based systems being to your organization's plans? _____ Why? _____

    _____

    _____

THANK YOU

Interviewer: (Rate the intervieww's disposition as a source for additional information on the topic of micro-to-mainframe)

_____ Very informative

_____ Informative

_____ Not very informative

INPUT

APPENDIX B: MICRO-MAINFRAME VENDOR QUESTIONNAIRE

APPENDIX B

MICRO-MAINFRAME VENDOR QUESTIONNAIRE

Name: _____

Company: _____

Address: _____

Title: _____

1. How would you define the micro-mainframe market? _____

    _____

2. How large is it? 1984 dollar growth rate? _____

    _____

WHERE DO YOU FIT?

3. What micro-mainframe products do you currently offer? _____

    _____

4. What are their prices? _____

5. Future products? _____

    _____

6. What was your total company revenue in 1984? _____

7. What was your revenue from micro-mainframe products? _____

8. How many units of _____ did you ship? _____

9. What percent of your micro-mainframe sales are direct versus through
    retail or other channels? Will this change, if so how?

    _____

    _____

- l07 -

INPUT

COMPETITION

10. Who are your top three competitors in the micro-mainframe market?

_____

_____

11. Can you estimate 1984 market share? Units or expenditure installed base?

_____

_____

12. Who will be most successful in the near future? Why? _____

_____

STRATEGIC ISSUES

13. Key issues and trends in the micro-mainframe market?

_____

_____

14. Is support an issue? Why? _____

_____

15. Has your company developed alliances with other firms to develop or market micro-mainframe software? Who? In the future?

_____

_____

16. Will data interchange standards emerge? If so, how will they impact the micro-mainframe market?

_____

_____

INPUT

17. What will IBM do in the micro-mainframe market? Will they be a threat to you?

_____

_____

18. Bundling links as part of standard mainframe or micro package? _____

_____

19. Generic links versus specialized mainframe data base vendor link?

_____

_____

20. Any new opportunities you see in the market? _____

_____

Comments: _____

_____

_____

Name of someone in product technical support? _____

_____

THANK YOU

INPUT

APPENDIX C: DEFINITIONS

APPENDIX C: DEFINITIONS

- Microcomputer: Any microprocessor-based CPU which is programmable and has memory, monitor, and keyboard.

  - Subcategory.

    . Personal Computer.

      - Single user.

      - Standalone capability.

      - General purpose machine.

      Note: Excluded from personal computers: word processors, graphics workstations, CAD/CAM.

    . Intelligent workstation: same as executive workstation.

    . Executive workstation: a personal computer that is connected to a host, i.e., either a mini or mainframe.

INPUT

- Typical configurations.

    - Micro: monitor; 256K; two floppies or one floppy; one hard disk.

    - Low-end multiuser: hard disk; 512K; three terminals.

    - High-end multiuser: 68000; UNIX; seven to eight terminals.

- Assumptions.

    - Forecast includes computers used for business purposes that have the capability of serving as a standalone computer and are general purpose machines.

        - Can be connected to a host or to a network.

        - Can be multiuser. If so, just counts the CPU.

        - Counts intelligent workstations and executive work-stations.

        - Terminal must have some sort of storage, i.e., floppy disk drive.

- 112 -

INPUT